TECHNOLOGY DEPT.

AMERICAN MACHINIST

MAY 14, 1942

Plant Protection — Page 429

ARMAMENT: Percussion Fuze for Small Shell — Page 447

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WE ARE BUYING

U. S. SAVINGS BONDS AND STAMPS

WE ARE ALL MINUTE-MEN

For Every Minute Counts

Not only have we signed our war bond pledges through the payroll allotment plan but every member of the Heald organization also pledges his utmost in time, experience and facilities to all manufacturers who have problems or questions relative to precision finishing. We even go further and offer our assistance to defense industries and sub-contractors one hundred percent regardless of what their engineering requirements may be.

It is a service in a broader sense than just servicing our equipment, for with branch offices, fully manned with consulting engineers and experienced servicemen, located in cities close to defense sections all over the country, you can add us to your organization with a simple phone call which will get immediate response.

Once we tackle your job, our responsibility to give you complete satisfaction never ends.

Manufacturers of Precision Grinding and Borizing Machines

Tech

THE HEALD MACHINE CO. WORCESTER, MASS. U. S. A.

AMERICAN MACHINIST

May 14, 1942

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DETROIT

Watch on the Sky—Spotter, scanning the night sky for planes, is a key link in the plant protection system

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VOLUME 86 NUMBER 10

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MORE ADVANCE INFORMATION
on the big American Machinist
"MOTOR CARS to MUNITIONS"
number...coming June 11

As plant after plant stops production of civilian goods and tackles the job of tooling up for war, more and more Metal-Working executives are demanding specific facts on how to get going quickly.

The automotive plants of America are well on the way to complete conversion. How they are doing it . . . and how other present or potential producers of war materials can benefit immediately by their experience . . . will be reported in the June 11 issue of *American Machinist*.

Every Metal-Working production man will find this issue a timely, practical, important textbook on conversion.

A GUIDE TO THE LATEST ARMAMENT CONVERSION METHODS

Highlights of Editorial Content—Designed to Help SAVE YOU TIME *in the Race for Victory*

- A broad, over-all sizing-up of the big job faced by the automotive industry, interestingly written and dramatized with charts and pictures.
- A detailed, plant-by-plant report of how existing production layouts are being revamped for efficient war work.
- A description of how the vast network of automotive parts manufacturers is being coordinated into a vital unit of our giant armament-production program.
- A handbook of armament production practice, with countless ideas and suggestions on almost every phase of Metal-Working, applicable to problems in many types of plants.
- A manual of machine-tool conversion, with specific examples of:

a—How equipment formerly used for automotive manufacture is being converted to war production with new fixtures, jigs, dies, etc.

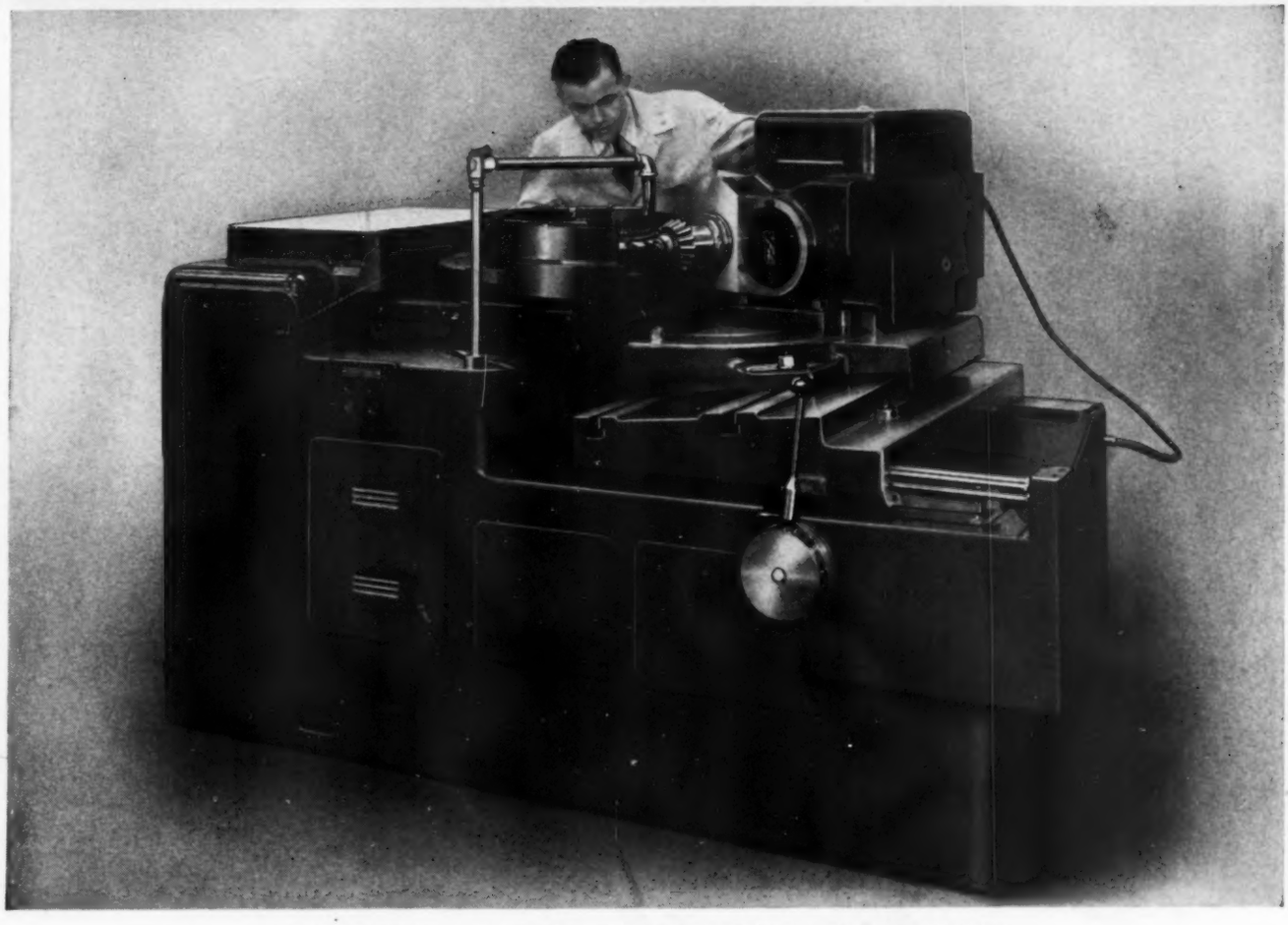
b—How entirely rebuilt machine tools — with new feeds and speeds, new heads, new bearings, etc.—are doing different jobs than those for which they were originally made.

- Typical examples of how veteran workers and new workers in peace-time plants are being trained in their new job of making the thunderbolts of war for Uncle Sam.

ALL EDITORIAL MATERIAL PASSED FOR PUBLICATION BY PROPER MILITARY AUTHORITIES

AN ISSUE TO READ, STUDY AND *USE* FOR MONTHS. WATCH FOR IT!

GLEASON ANNOUNCES AN ENTIRELY NEW METHOD AND MACHINE FOR ROUGHING STRAIGHT BEVEL GEARS

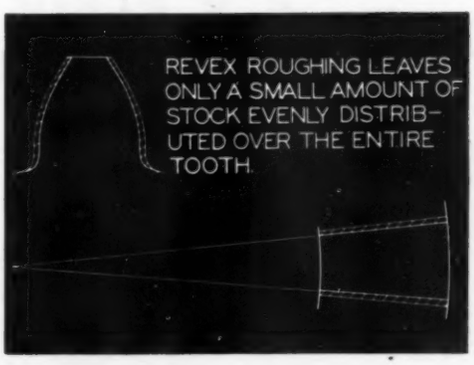


GLEASON No. 7 REVEX STRAIGHT BEVEL GEAR ROUGHER

On the new Revex Rougher, straight bevel gears are roughed closer to finish size than on any other roughing machine.

The Revex produces both the proper tooth taper and profile shape by the combined effect of the cutter motion and form of the cutter blades. Only a small amount of stock, evenly distributed over the entire tooth, is left for the finishing operation.

Revex Roughing is faster than other methods, and with the close roughing obtained, Gleason Generators finish-cut fully 30 to 40 per cent faster.



Send prints for complete information on how the Revex Rougher can increase your capacity and decrease your gear-cutting cost.

SPECIFICATIONS

Maximum Pitch Diameter (6 to 1 ratio)	14″
Coarsest Pitch	3 D. P.
Greatest Face Length	2″
Extreme Ratio (shafts at 90°)	6 to 1
Index Range	13 to 100 Teeth
Feed Rate	4 to 33 sec. per Tooth
Floor Space	40″ x 85″

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

If it's SKILLED HELP

BUY CINCINNATI No. 0-8 PLAIN

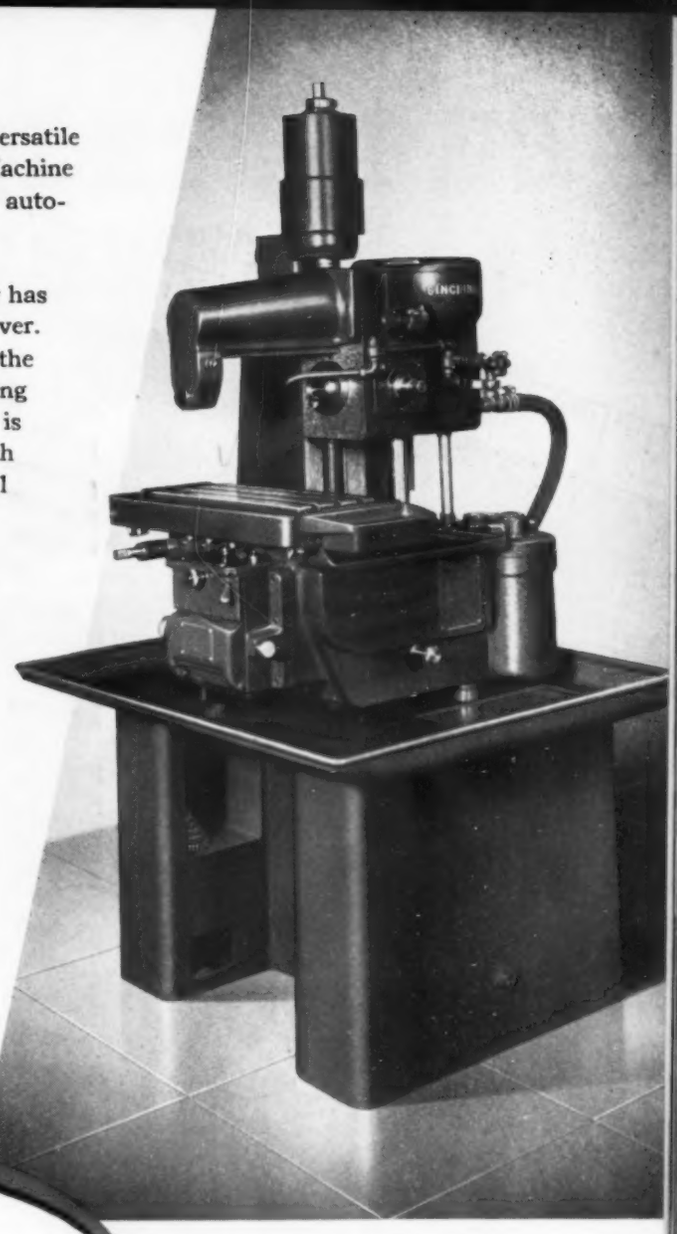
WIN *with a Cincinnati!*

● Most of the need for skilled help to handle the versatile CINCINNATI No. 0-8 Plain Automatic Milling Machine has been obviated by making the machine completely automatic and practically independent of the operator.

Yes — the skill is built into the 0-8 itself. All the operator has to do is load and unload the fixture and flip the starting lever. From then on the entire milling cycle is handled by the machine; the table returned to and stopped at the starting position. In many instances even loading and unloading is automatic — the operator just keeps the hopper filled. With this arrangement one unskilled person is able to keep several CINCINNATI No. 0-8 Milling Machines running.

Innumerable small parts are speedily, accurately and economically milled on the 0-8. When equipped with Rise and Fall Spindle Carrier it takes obstruction jumps automatically — handling blind cuts as easily as through cuts. And no experience is required to change from one operating cycle to another. Take out the camshaft assembly, put in another and go ahead. It takes only a minute or two and is a simple procedure.

So, if you mill small parts and it's skilled help you want—buy CINCINNATI No. 0-8 Plain Automatic Milling Machines. Specification catalog M-964 covering all features and their benefits sent on request. Write for your copy today.



you want...

AUTOMATIC MILLING MACHINES

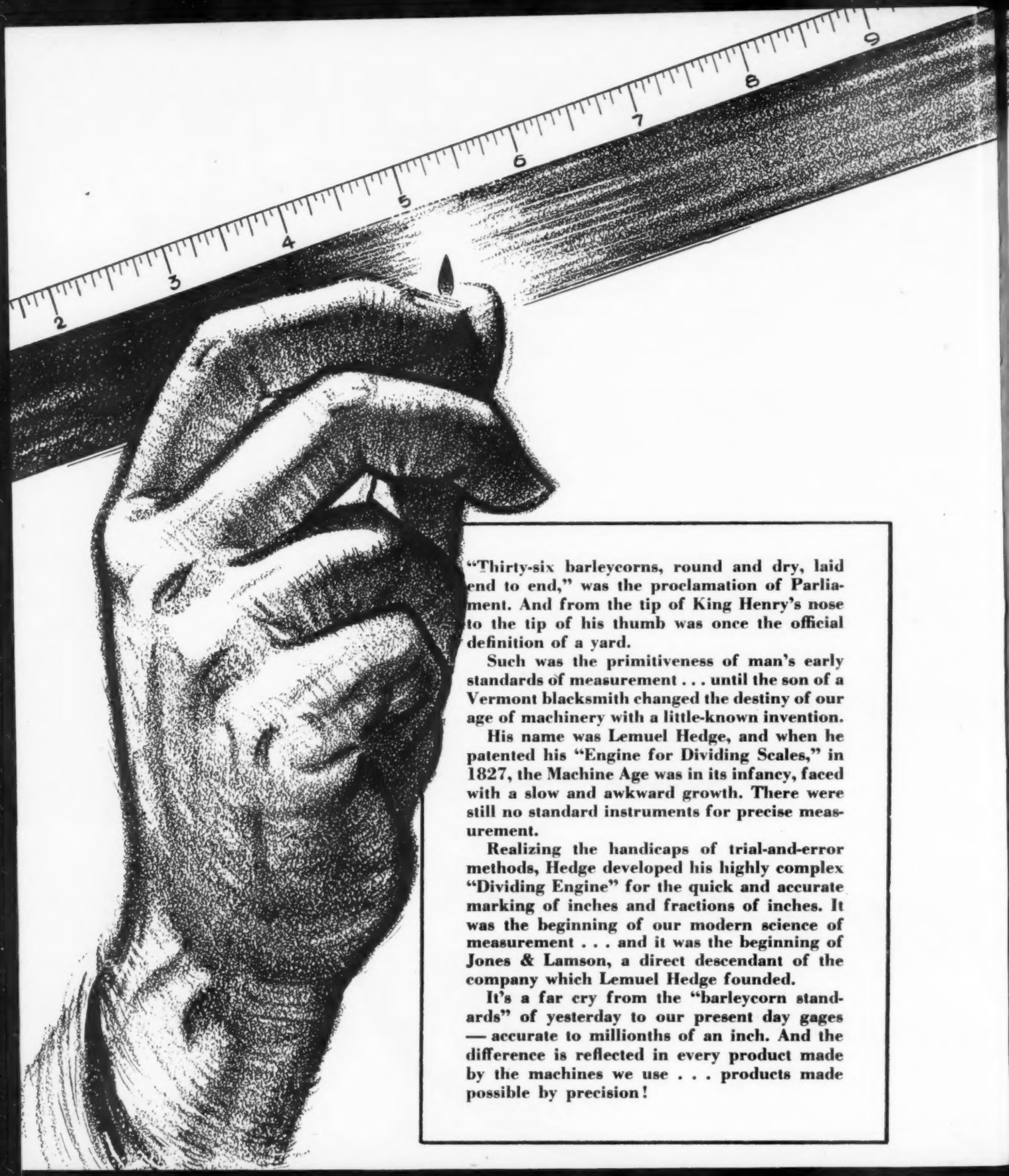
Illustrated above is the CINCINNATI No. 0-8 Plain Automatic Milling Machine equipped with Rise and Fall Spindle Carrier — ideal for milling small parts and capable of stepping up production — some users report as much as 50%.

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.

Cincinnati, Ohio U. S. A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES
SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES



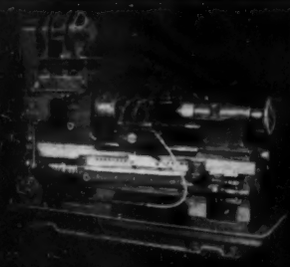
"Thirty-six barleycorns, round and dry, laid end to end," was the proclamation of Parliament. And from the tip of King Henry's nose to the tip of his thumb was once the official definition of a yard.

Such was the primitiveness of man's early standards of measurement . . . until the son of a Vermont blacksmith changed the destiny of our age of machinery with a little-known invention.

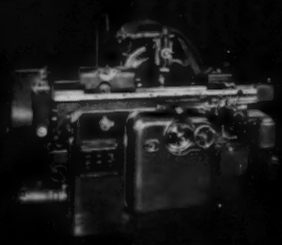
His name was Lemuel Hedge, and when he patented his "Engine for Dividing Scales," in 1827, the Machine Age was in its infancy, faced with a slow and awkward growth. There were still no standard instruments for precise measurement.

Realizing the handicaps of trial-and-error methods, Hedge developed his highly complex "Dividing Engine" for the quick and accurate marking of inches and fractions of inches. It was the beginning of our modern science of measurement . . . and it was the beginning of Jones & Lamson, a direct descendant of the company which Lemuel Hedge founded.

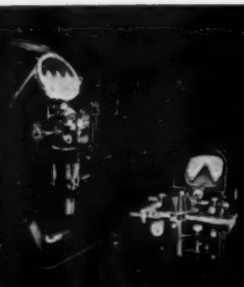
It's a far cry from the "barleycorn standards" of yesterday to our present day gages — accurate to millionths of an inch. And the difference is reflected in every product made by the machines we use . . . products made possible by precision!



FAY AUTOMATIC LATHES



AUTOMATIC THREAD GRINDERS



OPTICAL COMPARATORS

AUTOMATIC OPENING DIE HEADS

How many BARLEYCORNS make a FOOT?

Since the days of Lemuel Hedge, we, at Jones & Lamson, have maintained the highest standards of precision workmanship — have continually raised these standards for ourselves and others.

Twenty-two years ago Jones & Lamson pioneered a new method of gaging screw threads. It told, *at a glance*, *the complete story* of how a thread would fit its mating parts. This machine was the Jones & Lamson Optical Comparator. It was the first Optical Measuring and Inspection machine ever designed for practical shop use. Constant research has revealed an unlimited field for Optical Inspection and Measurement. It will not only measure and inspect all screw threads and related parts, but it will measure and inspect many irregular forms that are difficult, or even impossible, to measure mechanically.

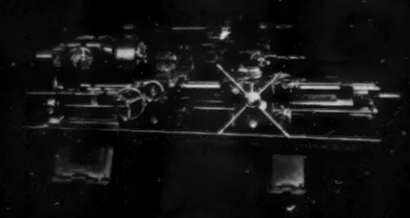
We invite any interested person to submit samples, or blueprints of parts, with tolerance to be checked — or Jones & Lamson representatives will study your inspection problems in your own plant.

JONES & LAMSON
MACHINE COMPANY

Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers

Springfield, Vermont
U. S. A.

PROFIT PRODUCING
MACHINE TOOLS



SADDLE TYPE
UNIVERSAL TURRET LATHE

RAM TYPE
UNIVERSAL TURRET LATHE

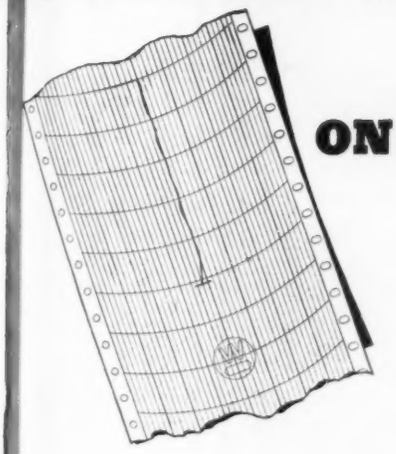
Speed **PLUS** Accuracy IN

The No. 24 above and the No. 12 at the left employ the same basic operating principle. The No. 24 holds the work in a horizontal, and the No. 12 in a vertical position. All profile elements and variations in gear teeth can be accurately checked and errors charted.

FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTION

IN MEASURING INVOLUTE PROFILES



ON GEARS UP TO 24 INCHES

In announcing a new addition to the line of Fellows Involute Measuring Machines, attention is drawn to the fundamental advantages of Fellows design. Functioning without, sine-bars, base rolls, etc., and requiring no difficult calculations, these machines are easy to set up and operate for inspecting involute profiles. Standard size blocks are used to set the involute pointer at the correct base circle radius. Both visual dial indicator, and electrical-recorded charts are calibrated in tenths-of-a-thousandth. The electrical recording device is of extreme sensitivity, and is designed for continuous trouble free service. For further details, write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit, or 640 West Town Office Building, Chicago.

CINCINNATI

if it's SKILLED

WIN *with a Cincinnati!*

CINCINNATI GRINDERS INCORPORATED

Cincinnati, Ohio U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES

Experts tell us that a minimum of thirteen million more men are needed in the war effort to back up the armed forces. Many of these men are going to operate machine tools. A portion of that group will be running grinding machines. Mighty few will be toolmakers, skilled mechanics, or even trained operators. Therefore, the solution to the skilled help problem must be in the machines themselves.

We don't say a "green hand" is able to master a Hydraulic Universal immediately. We do say that when CINCINNATI Hydraulic Universal Grinding Machines are used, unskilled help become proficient in a very short time because much of the skill has been built into the machine. Take a good look at the Hydraulic Universal and you will understand why this is true. Every element of manipulation is conveniently located and easily accessible to the operator's normal working position. Every feature is designed to give maximum efficiency, to help save valuable production hours and to speed deliveries.

On this precision grinding machine extreme accuracy is quickly and easily achieved . . . tolerances of less than .0001″ being practical. And accuracy is not wholly dependent upon the skill of the operator — it's a function of the grinding machine itself.

Further, on the CINCINNATI Hydraulic Universal maintenance has been practically eliminated. This grinding machine will give you Faster Set-up, Faster Handling, Faster Grinding, Faster Sizing. Hydraulic Universals are ideal for toolroom grinding and general manufacturing work. You'll find in them the answer to the skilled help problem.

Get all the facts. Send for specification catalogs G-484 and G-474 which give complete details on all features and why they will be beneficial to you. CINCINNATI Hydraulic Universal Grinding Machines are available in 12″, 14″, 16″, and 18″ swings, and between-center distances up to 72″.

HELP you want...

BUY CINCINNATI
HYDRAULIC
UNIVERSAL
GRINDING MACHINES

BROADEN YOUR RANGE

of Vertical Milling Set-Ups

WITH THE VAN NORMAN NO. 3-V VERTICAL

This modern vertical milling machine has the spindle mounted on a sliding ram. Simply by moving the ram in or out, the depth of the throat is varied so that the spindle can be more closely coupled to the column for average milling operations . . . which means an increase in range of set-ups and of work that can be handled.

This adjustable throat is only one of many important Van Norman advances in the design of vertical milling machines. Also notable are the quick-change levers, located on the ram, which instantly provide 18 spindle-speed changes . . . adaptability for step-milling by mounting 4-position dial indicator stop on the ram . . . single-lever feed selector . . . and directional controls of 18 feeds, located both at front and rear. These new features, together with extreme rigidity and accuracy, enable the Van Norman No. 3-V to set new performance-marks in output, adaptability and ease of operation.

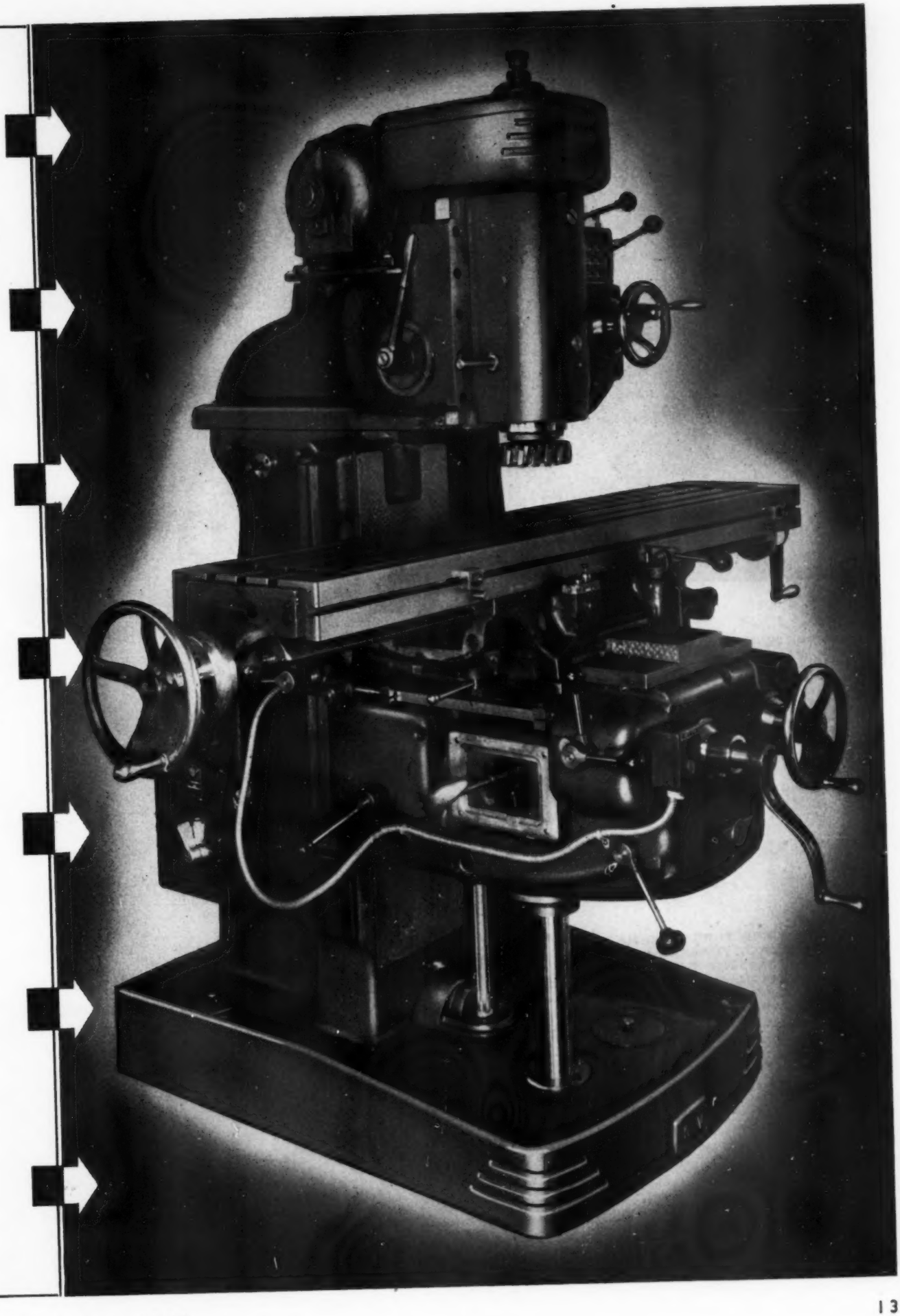
NO. 3-V SPECIFICATIONS:

Table: 64" x 14"
Vertical Spindle Adjustment: 5"
18 Speeds: 25 to 1250 RPM
18 Feeds: 3/8" to 32"

VAN NORMAN MACHINE TOOL COMPANY, SPRINGFIELD, MASSACHUSETTS

VAN NORMAN

Milling Machines



LANDIS
REG U.S. TRADE—MARK

BE THREADWISE

LANDISize *for*

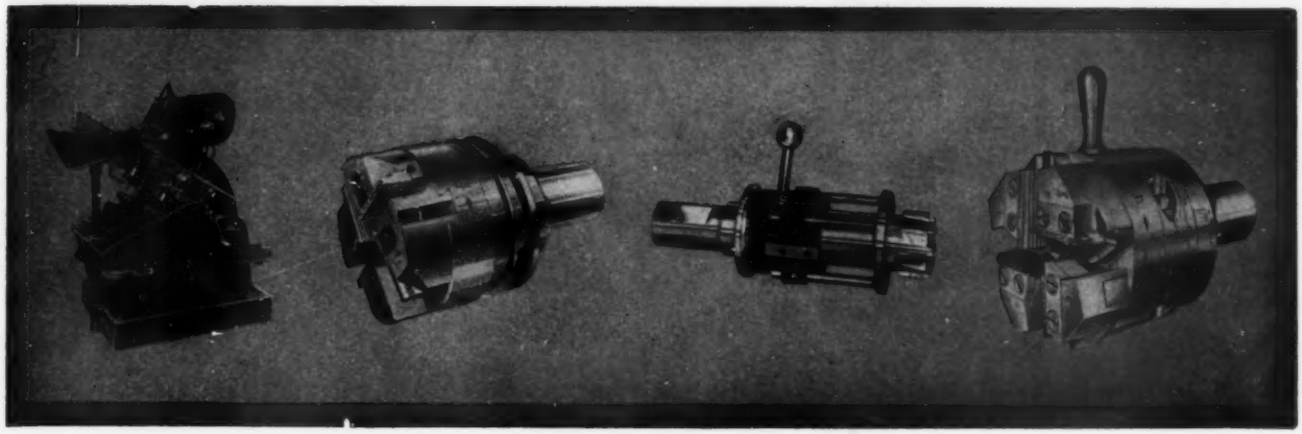
Finer Thread Accuracy

The LANDIS Line

STANDARD THREADING MACHINES
LANDMACO THREADING MACHINES
BOLT FACTORY THREADERS
AUTOMATIC FORMING AND THREADING MACHINES
PIPE THREADING AND CUTTING MACHINES
PIPE AND NIPPLE THREADING MACHINES
ROLLER PIPE CUTTERS
CHASER GRINDERS
ROTARY BOLT THREADING DIE HEADS
STATIONARY PIPE DIE HEADS
LANDMATIC HEADS FOR TURRET LATHES
LANDEX HEADS FOR AUTOMATIC SCREW MACHINES
LANCO HEADS FOR HAND-OPERATED THREADING MACHINES
LANDIS COLLAPSIBLE AND ADJUSTABLE TAPS

—and the LANDIS Precision THREAD GRINDER

LANDIS MACHINE COMPANY, Waynesboro Pennsylvania



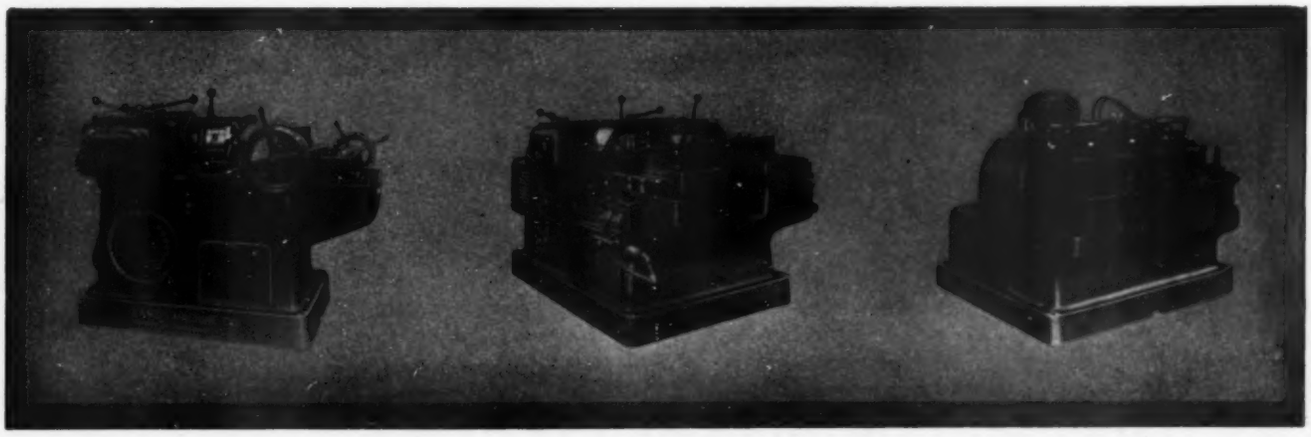
LANDMATIC HEADS *were Successful*

Threading special alloy steel rocker arm adjusting screws of approximately 200 Brinell hardness was a tough job in a mid-western plant before the installation of LANDMATIC Heads. In fact, no other equipment was successful on the job.

The thread – length 1½", diameter .5889" and cut to a tolerance of plus .000", minus .0025" is produced at the rate of 30 pieces per hour, and an average of 150 pieces are obtained per grind of the chasers.

Perhaps you have an equally difficult threading job or perhaps you may have other threading operations which could be handled more efficiently, and more economically, with LANDMATIC Heads.

Write for Bulletin No. F-90, today



EVERY CONTROL FROM THE HEAD *and* WITHIN EASY REACH *for* *QUICK* OPERATION

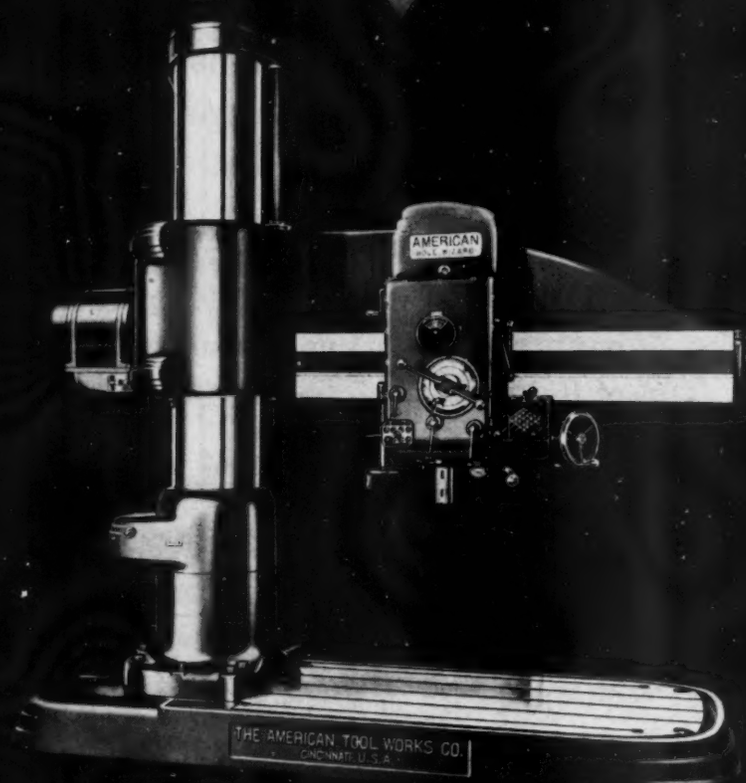
The "NEW" AMERICAN 32 SPEED HOLE WIZARD

Finger tip control is exactly what is provided on this newest of new "AMERICAN" Radials.

Not only are all controls from the head but all controls are centralized and most conveniently located within easy reach from the most natural operating position. Handling is remarkably fast and simple. Operators are amazed at the ease with which they can produce on this machine.

As a direct result of this highly developed control feature on the "AMERICAN" Hole Wizard, more holes per hour are definitely assured—and less drilling time per piece means greater returns from every pay-roll dollar.

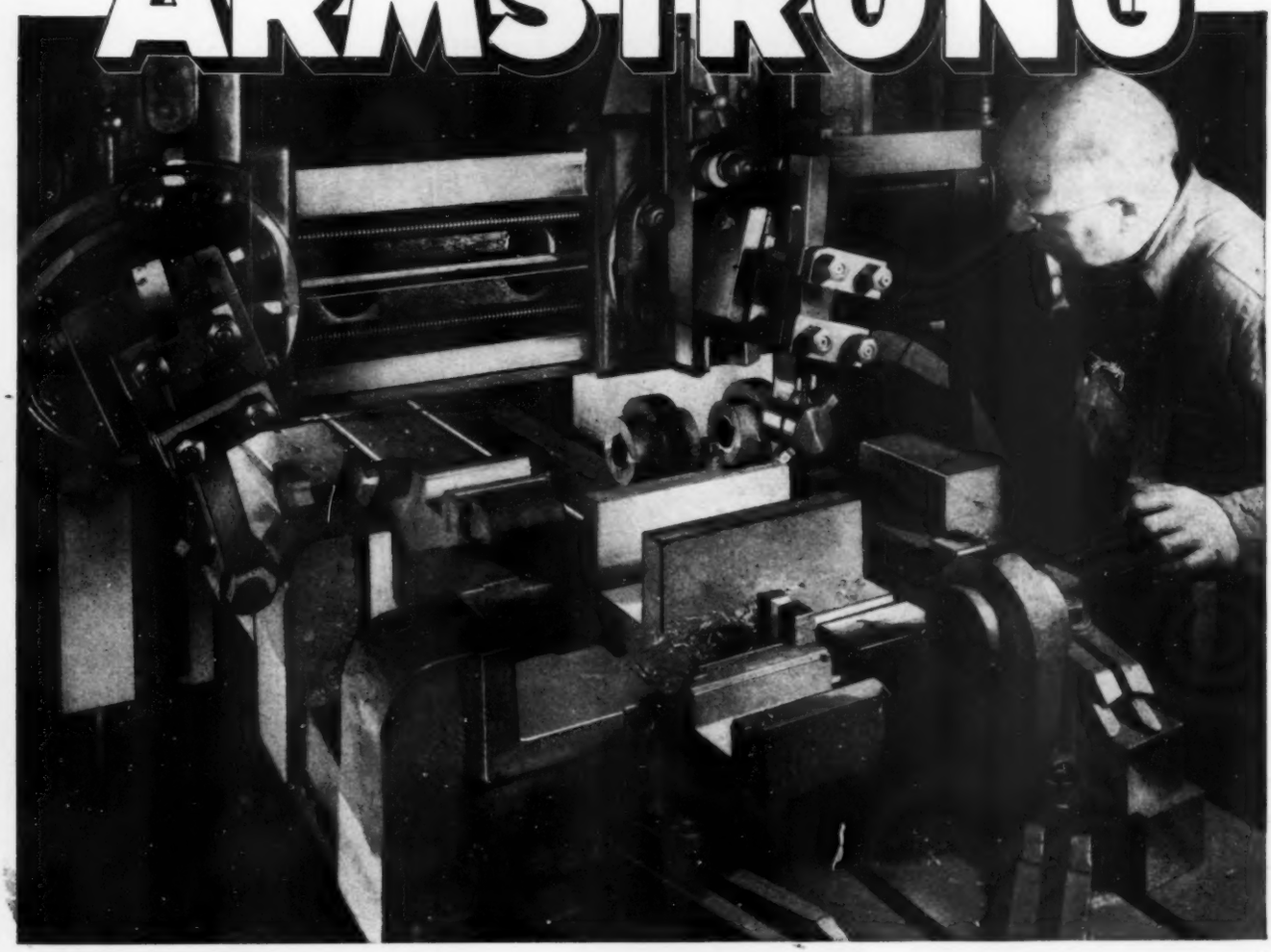
For complete facts, see Bulletin #326. Ask for your copy.



The AMERICAN TOOL WORKS COMPANY
Cincinnati, Ohio, U.S.A.

LATHES
RADIALS
SHAPERS

ARMSTRONG



"'Saves: All Forging, 70% Grinding and 90% High Speed Steel' has proved an understatement."

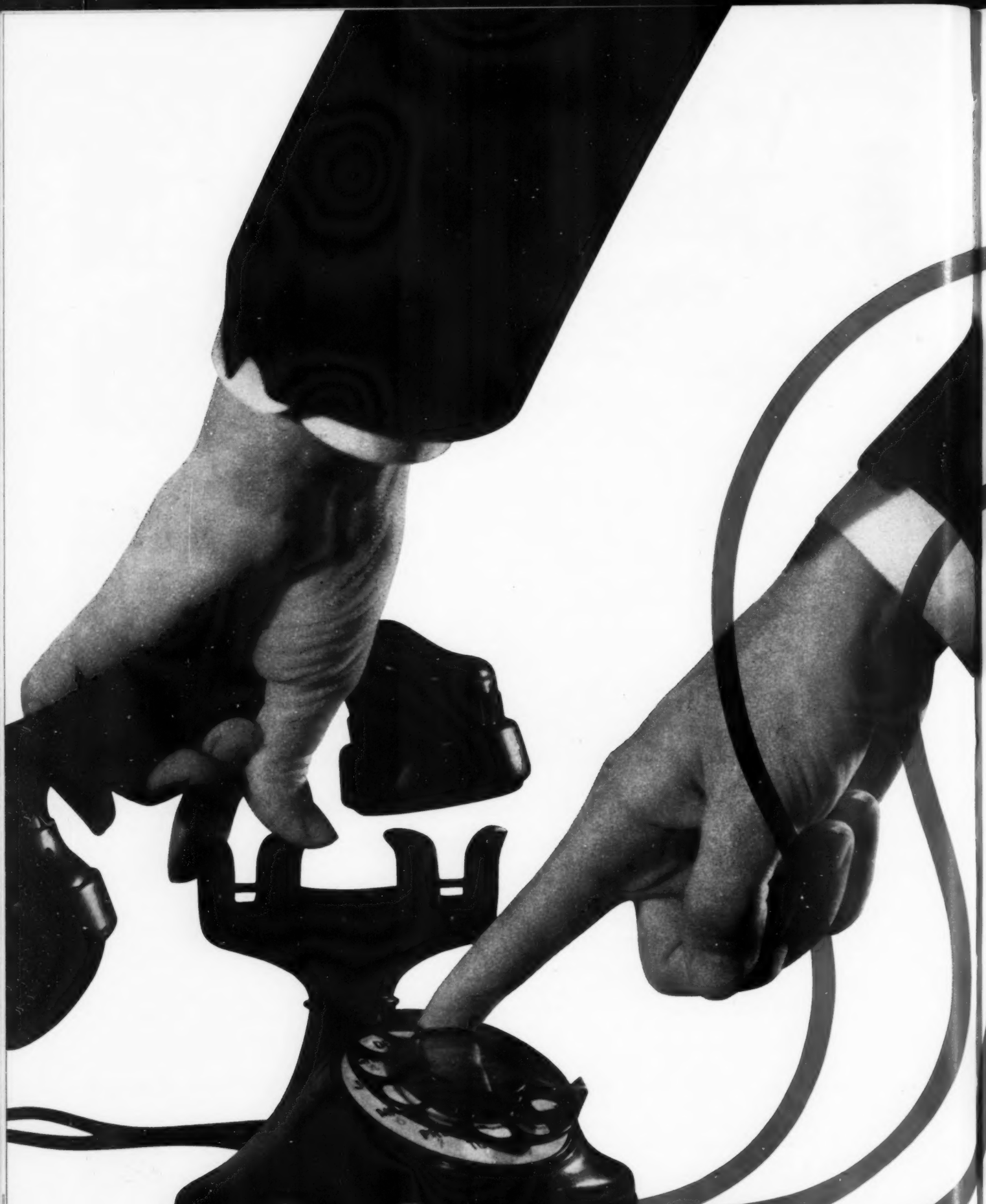
One of the nation's greatest industrials held out—continued to use forged tools for standard operations on lathes, planers, slotters and shapers even though more than 96% of the machine shops and tool rooms had gone over to ARMSTRONG TOOL HOLDERS. ARMSTRONG TOOL HOLDERS that took cutters any mechanic could quickly grind from stock shapes of high speed steel.

Then came the big test, one of the most comprehensive tooling studies ever conducted for it took months to complete: ARMSTRONG TOOL HOLDERS against solid tools, on lathes, planers, slotters and shapers—performance records tool for tool, operation for operation, comparison of strength, comparison of ouput, of capacity, tool life, cutting costs and all around efficiency.

The last summary of the many page report on this test pointed out that the Armstrong slogan "Saves: All Forging, 70% Grinding and 90% High Speed Steel" had proved a definite understatement. Now this great industrial too uses ARMSTRONG TOOL HOLDERS in all its plants.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. FRANCISCO AVE. CHICAGO, U. S. A.
Eastern Warehouse & Sales:
199 Lafayette St., New York

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms



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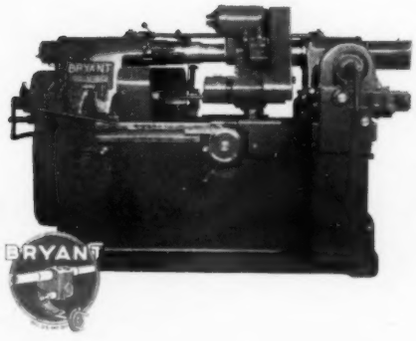
Put in a phone call for Bryant

"Operator, give me long distance — Springfield, Vermont, FIVE - SIX - O: Bryant Chucking Grinder Company — station to station."

When bothersome questions crop up on internal grinding jobs, time and money can often be saved if you put in a phone call for Bryant.

Whether the answer can be given at once in so many words, or whether Bryant can help you more by dispatching bulletins, memos, blueprints or even a service crew to the scene of action, you can count on a prompt response when you put in a phone call for Bryant.



Bryant's productive capacity, already tripled, is constantly increasing. No other organization in America of comparable size and experience is devoted *exclusively* to designing and building machinery for internal grinding work.

Not only should Bryant engineers be able to help you speed defense, but they welcome opportunities to begin work, *at the earliest possible stage* on new products for post-war markets.

If you believe in planning ahead, put in a phone call for Bryant.

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

"*Your* JOB IS *Our* JOB–

Carpenter

BRANCH WAREHOUSES AT—Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, Philadelphia.

now, more than ever before"

MAKING TOOLS that will produce more pieces in less time is a job that you and Carpenter can do *together.* Getting continuous production from machines and presses, with fewer interruptions for regrinding, repairing and replacing tools, is more than a one-man job.

Just as always, Carpenter's policy of help to tool steel users goes beyond the supplying of quality tool steels. Continuous production calls for good design, careful steel selection, expert tool making and exact heat treating procedure. Right there is where Carpenter can help you—with a *simplified* program for the proper selection and correct heat treatment of tool steel to do each job.

As a part of Carpenter's program of "All Aid To Tool Steel Users", we offer this handbook, "Tool Steel Simplified". It is being used in tool rooms, machine shops, and heat treating departments—to make *every* pound of tool steel contribute its share to faster production. The chapter on "The Relation of Design to Heat Treatment" contains information that has already saved many hours and much valuable tool steel in many tool rooms. Three chapters on heat treating procedure make this handbook a particularly valuable reference source for the hardening room. "Tool Steel Simplified" helps train apprentices faster and is a good "refresher" course for tool makers.

Over 22,500 copies of "Tool Steel Simplified" are at work helping plants produce *better tools* that will do the work *more quickly.* It answers questions like these: *How* to stop tools from warping? *How* to avoid grinding checks? *How* to make tools wear longer? *How* to prevent size change? *How* to be a trouble shooter?

"Tool Steel Simplified" is available to you at cost—only $1.00 postpaid in the United States—($3.50 elsewhere). Send today for this aid to better tools and higher production. We believe that after you have read "Tool Steel Simplified", you will want more men in your plant to have copies of this book.

THE CARPENTER STEEL COMPANY
Dept. 109, READING, PA.

This helpful handbook is aiding tool engineers, tool makers and heat treaters in their efforts to make *every* pound of tool steel contribute its share to *continuous* and *higher* production. ($1.00 in U.S.A.)

TIMELY TIPS

Little things to remember today to get the most out of every pound of tool steel. "Timely Tips" are gathered from the note books of Carpenter Servicemen, whose everyday job it is to help you solve tool problems and get increased production.

"Haste makes waste" is an old familiar motto that has a mighty important meaning today when everyone is pushing production to the limit. Haste certainly can make waste in tool making—waste of vital material—and waste of skilled labor. Hurrying jobs through the hardening department is the easiest way to get into trouble—so on the wall of every hardening room should hang *this* motto *"Make haste slowly".*

THE CARPENTER STEEL CO., Reading, Pa.

MATCHED TOOL STEELS

"SW" ...the electrode that has OUTGROWN ITS INITIALS*

*To describe the job it was designed to do... sheet welding... this electrode was named "SW".

MAYBE YOU ALREADY KNOW WHY!

"SW" can be used in any position.

"SW" can be used for all types of fabrication welding, but especially for light sheet metal work and other jobs requiring low heat input to work.

"SW" is supplied in $\frac{3}{32}$", $\frac{1}{8}$", $\frac{5}{32}$", $\frac{3}{16}$", $\frac{7}{32}$" and $\frac{1}{4}$" diameters.

"SW" meets code requirements of A.W.S. and A.S.T.M. Tentative Electrode specifications for classifications E-7010, E-7011, E-6012 and E-6013.

Flexarc "SW" electrode was developed especially for welding light sheet steels, and particularly for use with low capacity a-c welders. And how it filled the bill! Any reasonably skillful welder could make a good sound weld on sheets as thin as $\frac{1}{32}$", using $\frac{3}{32}$" diameter "SW"—without danger of burn-through.

But that's not all.

Users found "SW" equally well adapted to heavy gauge metal and all types of general steel welding. They liked its uniform metal transfer, its easy arc strike. Then when they found it could be used in all different positions using a-c or d-c, they demanded "SW" in larger diameters. That's why you can now get "SW" in diameters from $\frac{3}{32}$" to $\frac{1}{4}$". Try it! Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-21195

Meet the rest of the family

Flexarc FP—Use FP with a-c and d-c for *fillet position* and general purpose high-speed welding on low and medium carbon steels.

Flexarc DH—Use this "hot" high-speed rod on a-c or d-c for *downhand* position on heavy horizontal fillets and finished beads.

Flexarc AP—Use AP for all position welding on low-to-medium carbon steels to get minimum spatter. Reverse polarity d-c.

Castingweld and Free-machineweld—For welding iron castings. Latter type can be machined.

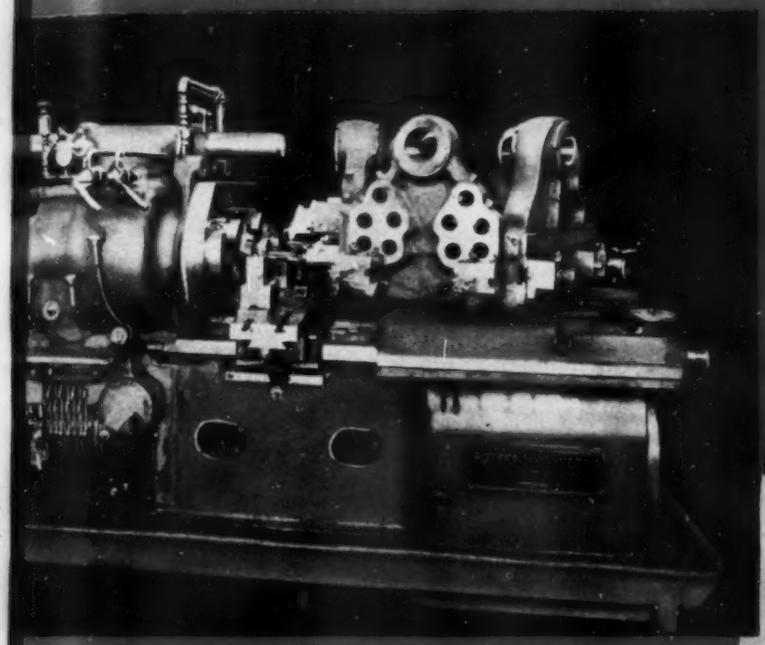
Hardentough—For hard-surfacing parts of machinery.

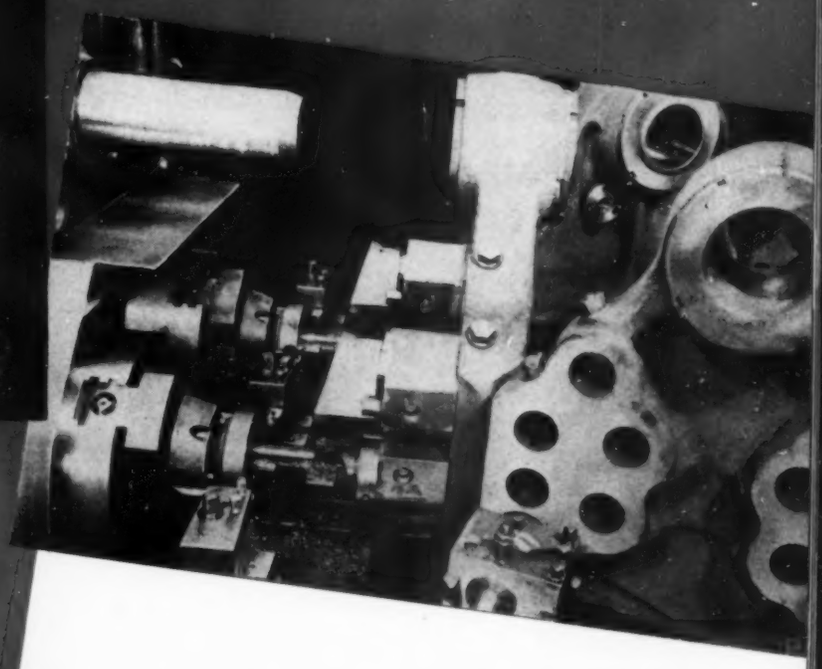
For Special Welds—Nickel-chrom, Nickelmang.

Westinghouse

FLEXARC ELECTRODES

*Results FROM PLANNED PRODUCTION ON A P&J 5D Two Spindle POWERFLEX





* 23 TRACTOR PARTS PER 51-MINUTE HOUR.

THE JOB AND HOW IT IS HANDLED

Part: Tractor Track Roller Shaft Bracket
Material: Malleable Iron
Machining Time: One operation only—Two subjects 3.91 minutes
Floor to Floor Time: 4.21 minutes
Production: 23 Brackets per 51 minute hour

Operation: Cross slide operates simultaneously with the tools mounted on turret allowing rough and finish facing cuts to be taken without loss of time. It also provides an operating mechanism for auxiliary slide tool mounted on turret face. Tools mounted on the auxiliary slide tool are used for machining of angular recess groove.

Machining Operations:
1st T.F.: Rough bore hole; bore and face 3⅝" dia. turn O.D.
2nd T.F.: Rough face end; rough machine groove for belt oil seal
3rd T.F.: Finish bore hole; bore and face 3⅝" face end
4th T.F.: Finish machine groove
5th T.F.: Ream hole

The advantages of 2-spindle output from single spindle floor space as well as savings in power and initial investment are being realized in many shops where these P&J automatic Chucking Machines are installed.

A recent installation in the plant of a mid-western tractor manufacturer exemplifies these advantages. Note from the photographs the simple form of tooling required for producing track roller shaft brackets. The tool holders mounted on the several turret faces as well as the extremely rigid form of overhead pilot are features included in the standard 2-spindle machine at no extra cost.

P&J offers the 5-D 2-spindle POWERFLEX in three sizes, 9", 12" and 15". The outstanding characteristics of all sizes are extreme rigidity of spindle mounting, turret slide and cross slide, long life, and maintained accuracy under high production demands.

On the class of work shown here, one operator can readily handle three machines of this type.

POTTER & JOHNSTON MACHINE CO.

PAWTUCKET, RHODE ISLAND

Production Up...Rejects down with G-E Fluorescent Lighting!

CASE NO. 51

Inspection department of a war industry plant. Since new fluorescent lighting was installed, inspection of small parts has been speeded up...errors reduced, and production increased. Better lighting helps workers see faster with less fatigue.

THE actual case described above is only one among scores of cases studied by General Electric to show specifically what advantages better lighting . . . in this case, G-E Fluorescent Lighting . . . offers industrial plants.

If your plant is faced with the problem of getting more and better war production without adding any extra floor space, machinery, or workmen, cool indoor daylight with G-E MAZDA F (fluorescent) lamps in certified fluorescent lighting fixtures may be the answer.

However, if you must make your present lighting system do for the duration, here are some things that can be done to make a big difference in its effectiveness:

1 Use soap and water on a *regular* cleaning schedule.

2 Right size bulbs in present fixtures.

3 Reallocation of present lighting to fit new demands.

4 Supplementary lighting for the most critical seeing operations, such as inspections.

5 Light colored walls to reduce light absorption; light colored finishes on machinery to increase visibility.

6 Frequent light meter checks on maintenance.

Only if these other methods are inadequate, should new incandescent or fluorescent installations be made. See your G-E lamp supplier or write to General Electric Company, Dept. 166-AC-5, Nela Park, Cleveland, Ohio.

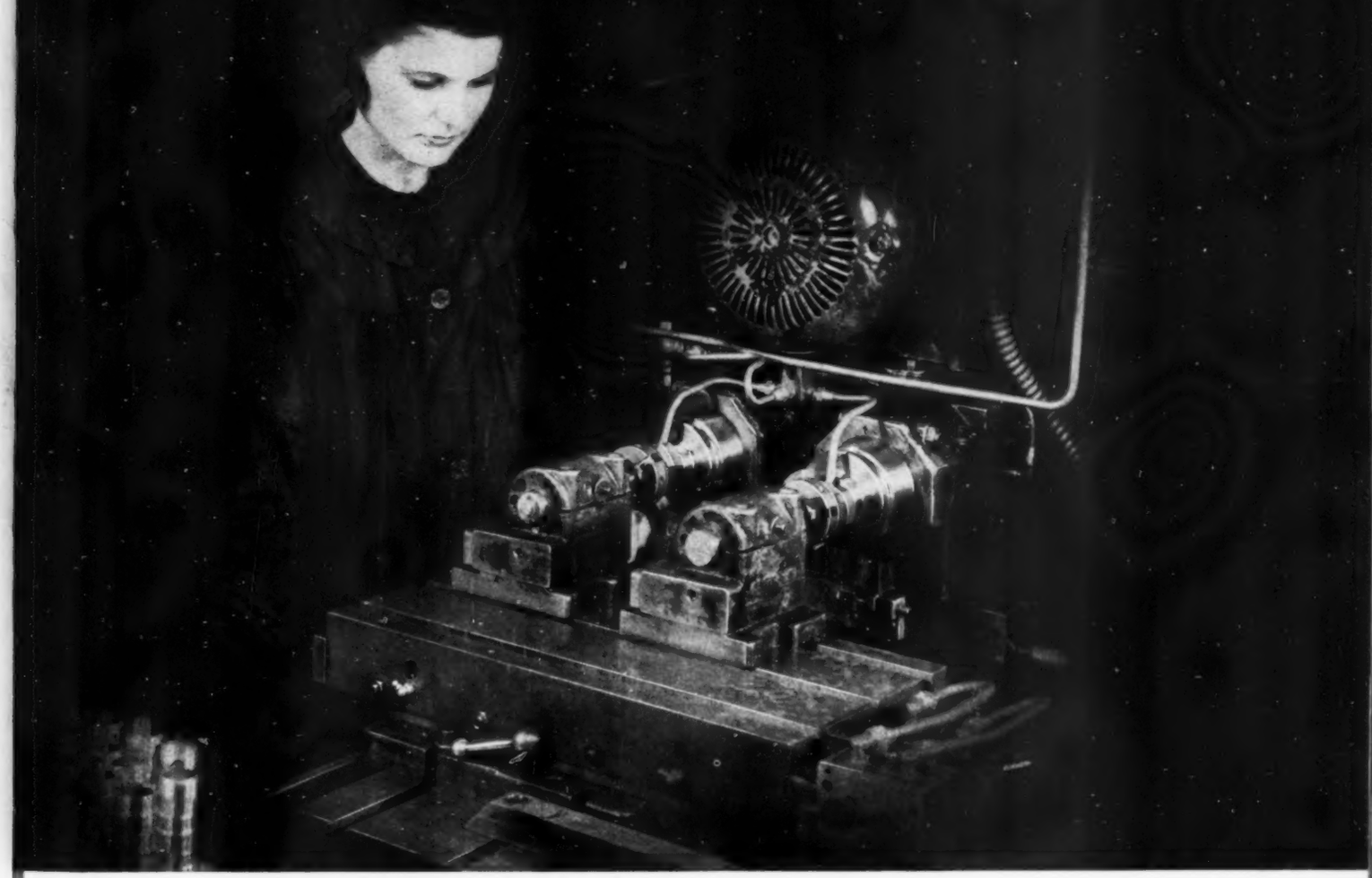
G-E MAZDA LAMPS

GENERAL ELECTRIC

Made to stay brighter longer

Want maximum light for the current consumed? Then look for the G-E monogram on the lamps you buy.

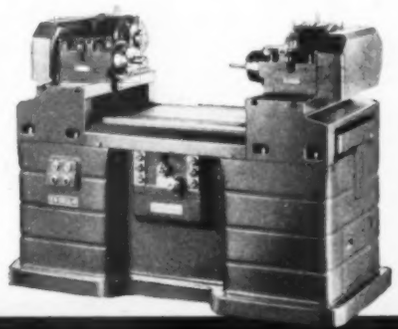
WINNING THIS WAR IS EVERYBODY'S JOB



Thousands of new workers are pouring into factory doors to help produce the billions of dollars' worth of material vitally and immediately needed to win this war . . . sufficient long-experienced operators are just not available . . . it's a time when a modern type of standard machine tool like the Ex-Cell-O Precision Boring Machine can meet the emergency by doing a dual job: its easy control and automatic operating features make it possible to train ordinary operators in an exceptionally brief time to bore, turn, face, groove metal parts to the highest commercial standards of precision in size and finish, with a minimum of operator fatigue; this ease of operation, combined with basically sound engineering design and substantial, rigid construction for which all Ex-Cell-O machine tools are noted, *assures the extreme in production, every hour, every day.*

EX-CELL-O CORPORATION • DETROIT, MICHIGAN

Below: Standard Double-End Ex-Cell-O *Precision* Boring Machine—used for many multiple and progressive operations, on the same part or various parts, to speed up war production.

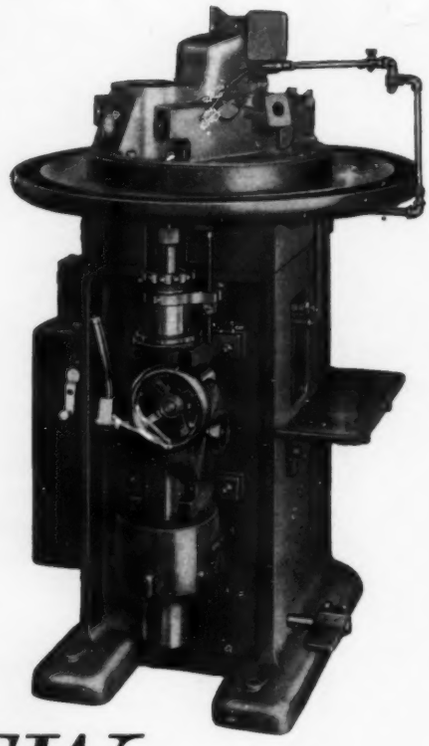


XLO

EX-CELL-O *means* PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, PARTS

Taft-Peirce Announces...



THIS *NEW* BACK SPOT FACER

THIS MACHINE, already specified by leading aircraft motor manufacturers, was designed for counterboring or back-facing bosses through which a hole has been drilled, but which, because of obstructions, cannot be counterbored or faced on a drill press, without complicated tooling.

The work is mounted on a 28″ circular cast-iron table, near the front of which is a hole which allows the shank of an inverted counterbore to project through the table. The unit containing the cutter spindle, driven through bevel gears by a ½ h.p. motor, is located in the base.

The counterbalanced spindle is provided with fast and slow hand feeds. The machine is available with or without clutch for disengaging the power from the spindle. Write today for bulletin containing complete specifications.

THE TAFT-PEIRCE MANUFACTURING CO.

Woonsocket *Rhode Island*

P&W Photo—Unretouched

STANDING still? Not *this* milling cutter, mister! Twenty-four hours a day, *every* day, it's scooping big chips out of crankcases that are about to chase little yellow sons of Nippon right out of the sky. There are American aircraft engines being built — and *fast*, mister!

P&W cutting tools — reamers, taps, dies, end mills — are in there pitching, rapidly, *accurately* . . . consistently delivering *extra* cuts per grind.

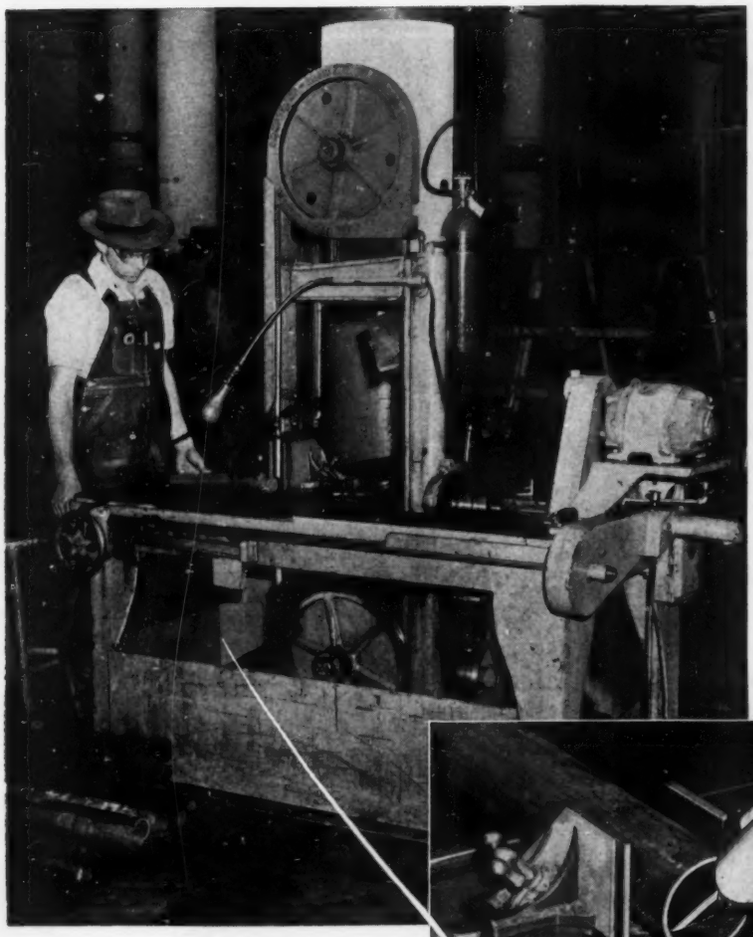
The photo? No standstill pose that, but shot on the job at 1/100,000 sec., to show you just a sample of the hundreds of kinds of P&W precision tools now building American war strength in top-speed 3-shift production.

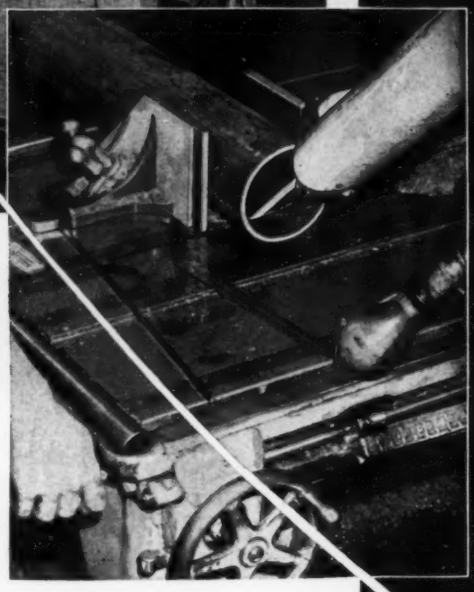
Don't spare the pressure. Your P&W tools can take it.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

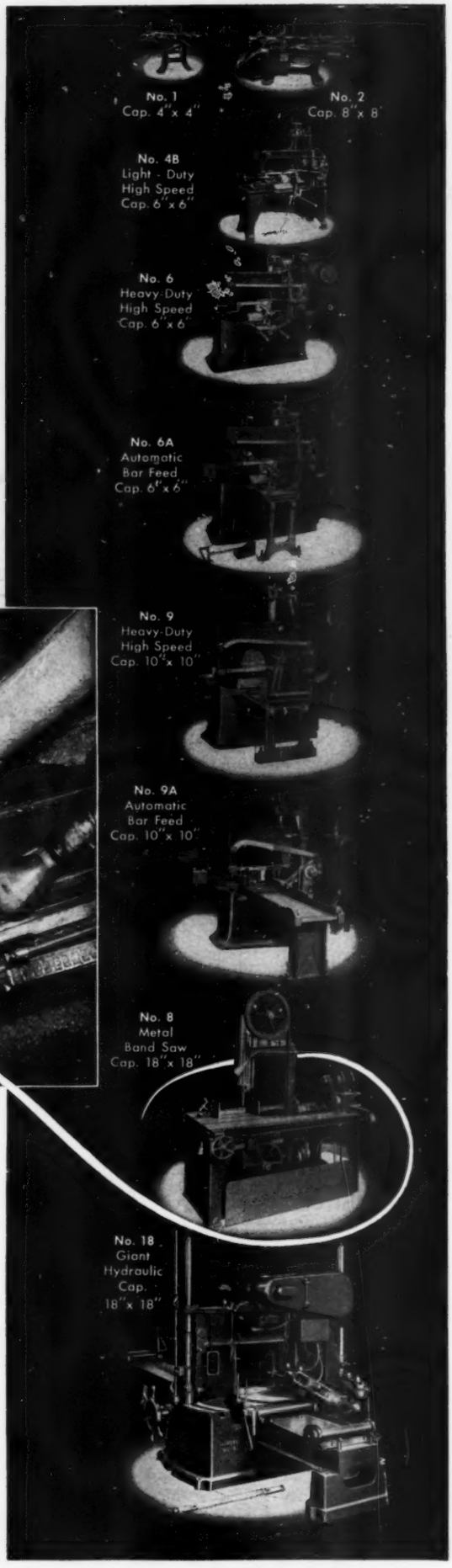




at

Vultee Aircraft

--"cuts can be made that are not obtainable on any other saw!"



At Vultee Aircraft Inc., this MARVEL No. 8 "has a very wide use" and "has proved a very efficient machine," for it is in continuous use sawing Pipe—all diameters; Bar stock—both machine stock and tool steel; Structural steel—angles and shapes and Steel Plate. What other saw could make the angle cut illustrated in the close-up but the universal MARVEL No. 8 Metal-cutting Band Saw on which the blade feeds into the work at any angle from 45° right to 45° left!

MARVEL SAWS

ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"
5700 Bloomingdale Ave., Chicago, U. S. A.
Eastern Sales Office: 225 Lafayette St., New York

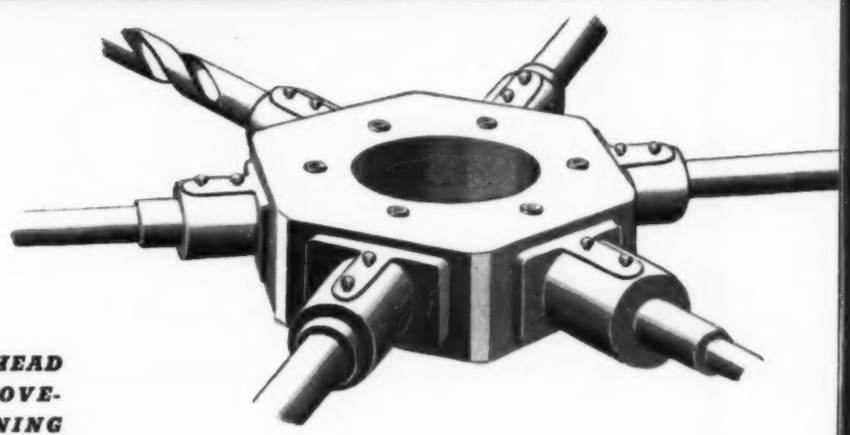
"Those boys are looking to me!"

● "They're shooting the works, those fellows! Gambling everything. They're 'fronting' for *me* . . . my own kid brother among 'em!

"I feel as though their eyes were on me. Asking 'How much—how soon?' . . . for ordnance, airplanes, tanks, ships, trucks. There must be no shortage of the equipment and materials they need to win.

"That's our job—*my* job—to keep 'em flying . . . rolling . . . marching! *Better* equipment and *more* of it!

"All right! If it's a war of machines they want, that's right down my alley. My lathe can take it. So can I!"



LOOK AHEAD . . . KEEP AHEAD . . . WITH GISHOLT IMPROVEMENTS IN METAL TURNING

GISHOLT MACHINE COMPANY, 1201 EAST WASHINGTON AVENUE, MADISON, WISCONSIN

TURRET LATHES · AUTOMATIC LATHES · BALANCING MACHINES

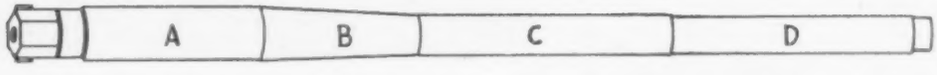
TO FINISH THE JOB QUICKER

GRIND THE

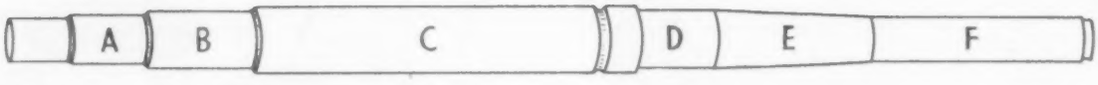
Left:--One of 4 diameters at the breech end of an anti-aircraft gun barrel being ground on a Landis 10"x 72" Type C Plain Hydraulic Grinder.

Lower Left:--Other types of gun barrels now being ground on Landis grinders. The diameters ground are identified.

PRECISION LANDIS GRINDERS



Above is shown a drawing approximately similar to a machine gun barrel now being ground on a Landis 10" x 36" Type C Plain Grinder. Straight diameters A and D, and tapered diameter C are traverse ground. Diameter B is ground by using the Landis hydraulic straight infeed method.



The above drawing is approximately similar to another type of gun barrel being ground on a Landis 10" x 48" Type C Plain. Straight diameters A, B and D are ground by using the Landis hydraulic straight infeed. Straight diameters C and F, and tapered diameter E are traverse ground.

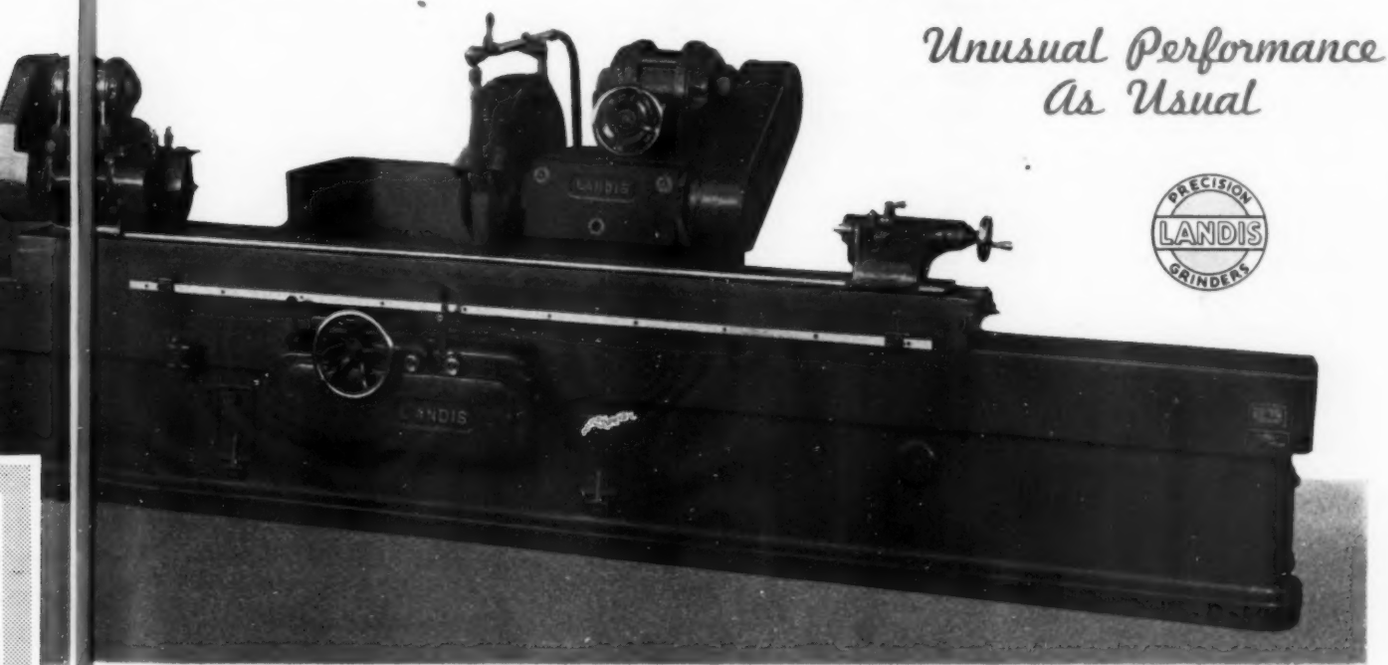
YOUR GUN BARRELS LANDIS WAY .. Like This

Past experience always influences future actions. For this reason the satisfactory performance of Landis grinders over the years has caused a number of manufacturers to select similar equipment when converting their facilities for machine gun and rifle production.

A manufacturer of 20 mm. anti-aircraft guns uses a Landis 10" x 72" Type C Plain Grinder for the following operations on the gun barrel -- rough grind 5 straight diameters, spot grind for work rest, finish grind 4 straight diameters at breech end and finish grind 3 tapered diameters at muzzle end. Like others, for gun barrel grinding this manufacturer uses Landis machines exclusively.

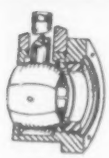
The major reason for the success of Landis Type C Plain Hydraulics on gun barrel work is the time-saving combination of hydraulic straight infeed and hydraulic work table traversal. Both straight infeed and traverse operations may be performed on the same machine with maximum efficiency and with instantaneous change-over from one to the other. This same outstanding feature may step up your output as it has many possible applications.

Unusual Performance As Usual



PRECISION LANDIS GRINDERS

LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA

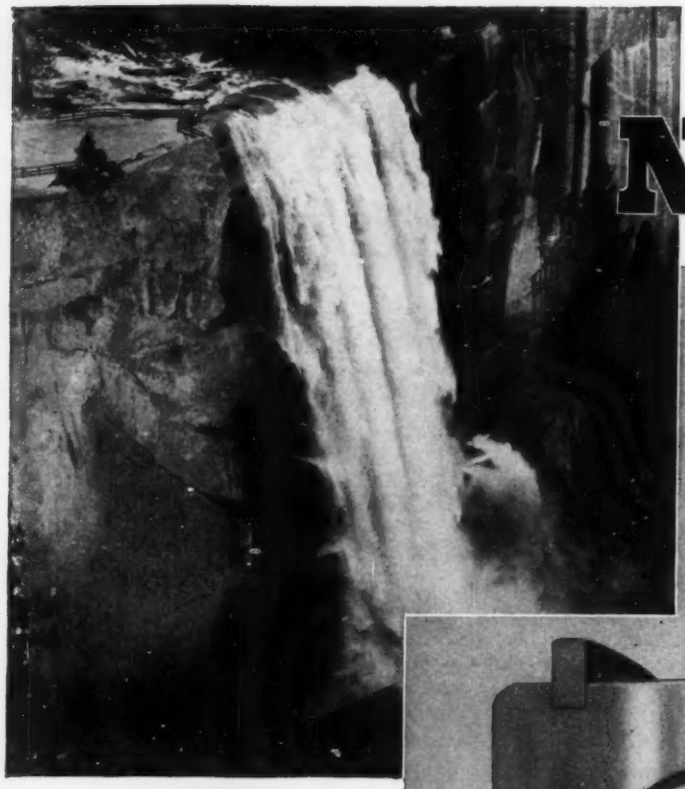


MICROSPHERE WHEEL SPINDLE BEARINGS.

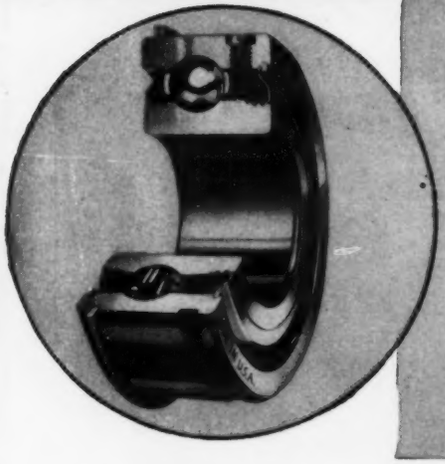
MULTI-SPEED HYDRAULIC WORK TABLE TRAVERSAL.

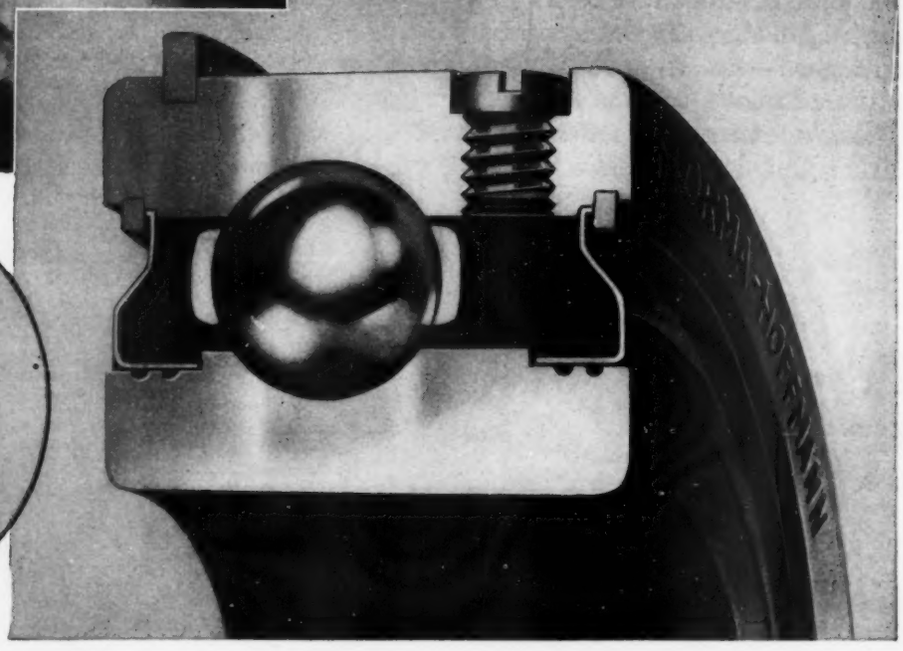
HYDRAULIC STRAIGHT INFEED.

392



NO *Fear of* GOING DRY!





What water means to the earth, lubricant means to a bearing — life itself. And as the mountain stream provides an abundant and constant flow of water, so the exceedingly large grease capacity of the "CARTRIDGE" BALL BEARING provides constant and abundant lubrication to its raceways and rotating elements.

In the cross-section herewith, note how the DOUBLE-ROW WIDTH GIVES THE "CARTRIDGE" BEARING DOUBLE THE GREASE CAPACITY of the single-row type — guarding against premature dryness. Note also how the in-built metal seals confine the grease WITHIN THE BEARING ITSELF, REGARDLESS OF THE ANGLE OF THE SHAFT.

The "CARTRIDGE" BALL BEARING is equipped with close-fitting, wearless metal shields which, with recessed inner ring construction and two or more grease grooves, form a truly effective labyrinth through which THE GREASE CANNOT PASS AND DIRT CANNOT ENTER.

Adopt the "CARTRIDGE BALL BEARING as your insurance against neglected lubrication, and dirt and grease contamination. It is handled as an integrally sealed unit, needing no supplementary closure parts. It provides easier and quicker assembly and disassembly. It STAYS CLEAN before mounting, during assembly, or when removed, and has convenient regreasing and inspection features.

Write for the Catalog. Let our engineers work with you.

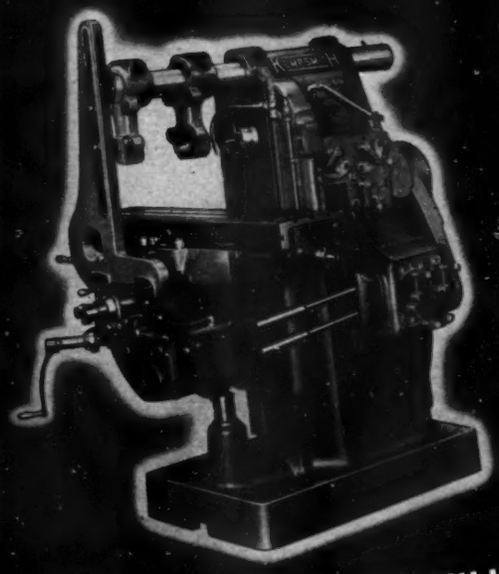
NORMA-HOFFMANN BEARINGS CORP'N., STAMFORD, CONN., U.S.A. • FOUNDED 1911

PRECISION BALL, ROLLER and THRUST BEARINGS

OK! WPB and INDUSTRY

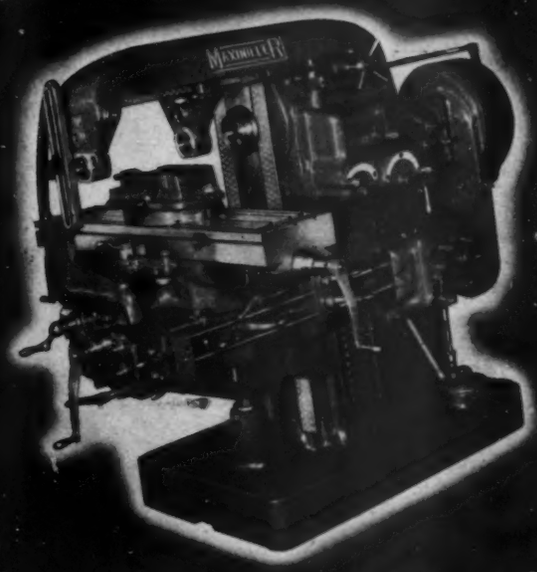
HERE'S MORE *Production Now!*

Industry's battle for more production now is being won today largely because it was won 54 years ago! The super-quality standards maintained by KEMPSMITH for more than half a century, are now helping industry to answer, successfully, war-production demands on a 168-hour week basis (420% x a 40-hour week EVERY week) . . . because KEMPSMITH Milling Machines are engineered and built to deliver that sort of emergency service. Sturdier . . . capable of heavier cuts without deflection or vibration . . . 18 speeds and feeds . . . KEMPSMITHS can be depended upon for more PRODUCTION NOW!



KEMPSMITH TYPE "G" MILLER

. . . . "brother" of the famous KEMPSMITH MAXIMILLER . . . economical in first cost; an efficient, precision miller for tool-room and light production work.



KEMPSMITH MAXIMILLER

. . . built to speed up production on 3-shift schedules . . . a rugged high-speed miller, with reliable accuracy and extra power for heavy, continuous cuts on long production runs.

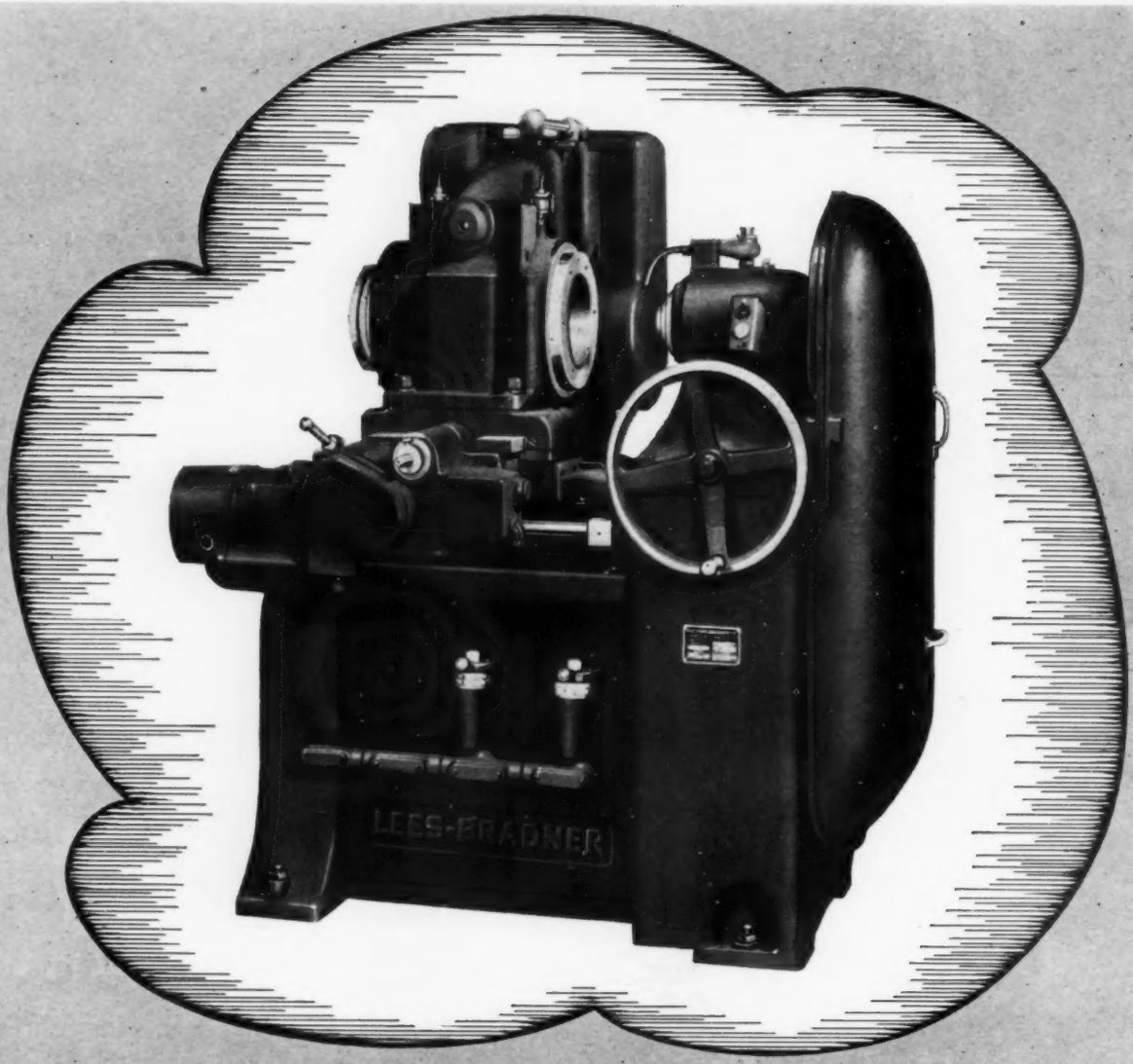
PRECISION

MILLING MACHINERY

Experience SINCE 1888

KEMPSMITH MACHINE CO.

MILWAUKEE • WISCONSIN



For the accurate generation of threads at high speed

THE LEES-BRADNER MODEL 40 THREAD MILLER

The Lees-Bradner Model 40 Production Thread Miller, designed and built by an organization long familiar with the requirements of mass production manufacturing is daily establishing new objectives in the field of precision threading.

The **LEES-BRADNER** *Company*

CLEVELAND, OHIO, U.S.A.

SHELLS
Today! Tomorrow!
A MESSAGE TO THE AUTOMOTIVE INDUSTRY
year ago these Bullard Mult-Au-Matics ere turning out automotive parts in a ell known Detroit plant. To- ay, with minor tooling changes, hey are machining shells. Some ay they will be back on auto- otive parts again.
As the automotive industry shifts to rmament production, it is receiving sig- ificant proof that the versatility of Bul- rd Mult-Au-Matics on any kind of job ithin their capacity makes for fast, low- ost production. This will be remembered hen peace comes.
BULLARD
THE BULLARD COMPANY
BRIDGEPORT, CONNECTICUT

HERE'S *What You Want . . .*

Bardons and Oliver

WHEN YOU BUY A TURRET LATHE

POWER TO SPARE – to handle today's carbide jobs.

ADEQUATE RANGE OF SPEEDS – because efficient production depends on the use of correct cutting speeds.

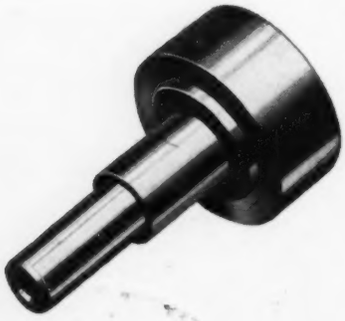
GREAT RIGIDITY – to permit heavy cuts at high speeds.

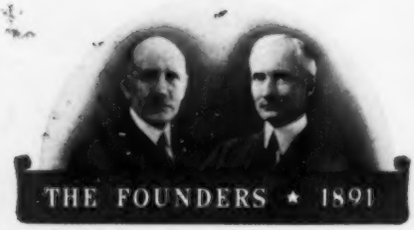
EASY OPERATION – to conserve your operator's energy.

HIGH DEGREE OF ACCURACY – to produce a high quality product.

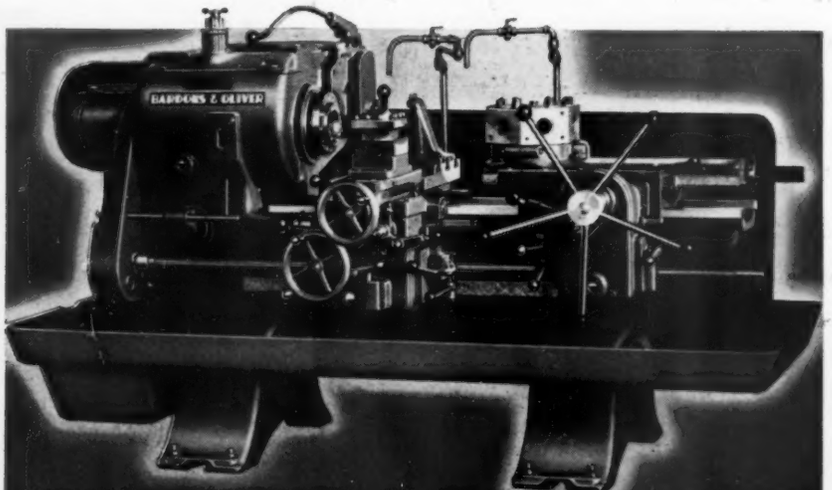
LOW MAINTENANCE – to keep your production rolling steady and your cost low.

All of these worthwhile advantages will be yours with a Bardons & Oliver Turret Lathe.





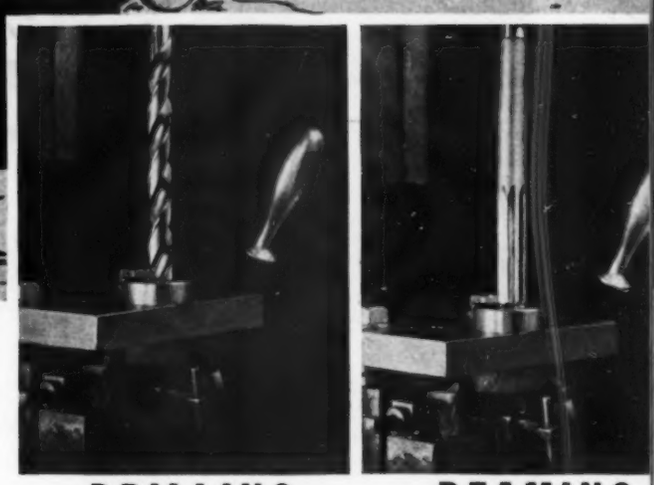
THE FOUNDERS ★ 1891



BARDONS & OLIVER, INC.

1133 W. 9TH ST. . . CLEVELAND, OHIO

FASTER WAR PRODUCTION



DRILLING

REAMING

COUNTERBORING

TAPPING

• Footburt Sensitive Drilling Machines help you meet those new production schedules needed to win the war. They are full range machines and are built in sizes to meet most small drilling requirements.

Spindle speeds from 185 RPM to 3450 RPM available on the No. 2 Machine. Made in 1, 2, 3, 4 and 6 spindle models. No. 3 machines have capacity up to 1¼" in cast iron.

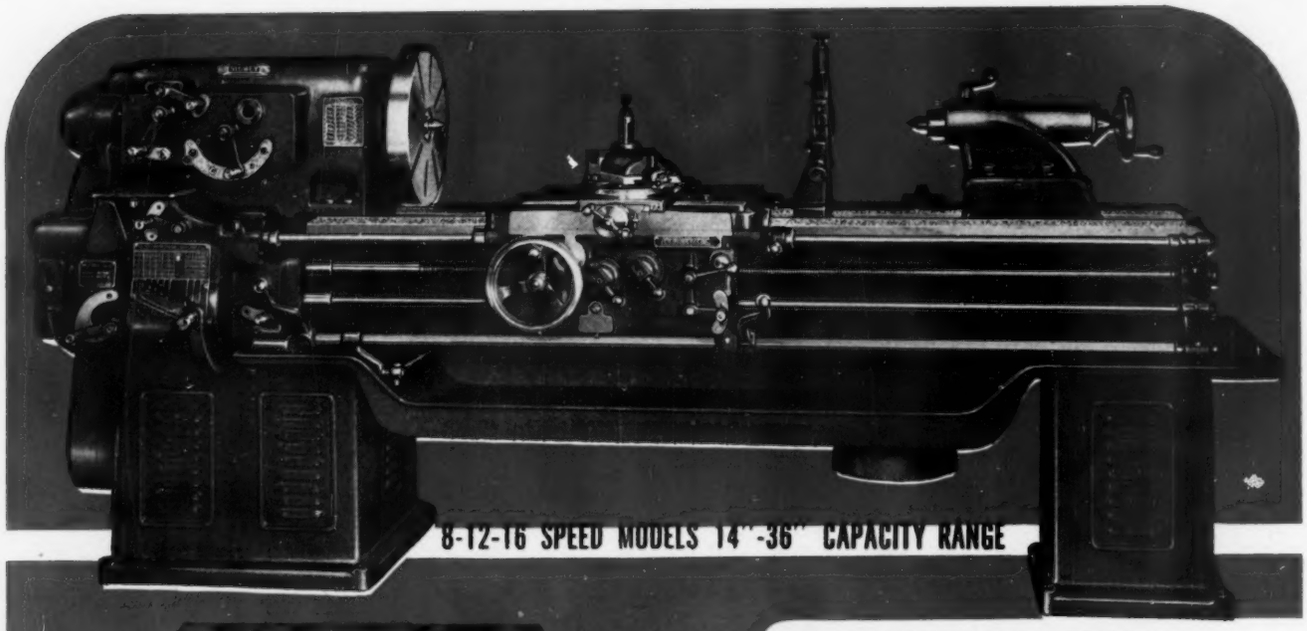
Power feed, back gear, built-in tapping and coolant furnish all the necessary attachments. Footburt Sensitives are rigidly built to drive cutting tools to their full capacity. Write for price and delivery information.

THE FOOTE-BURT COMPANY

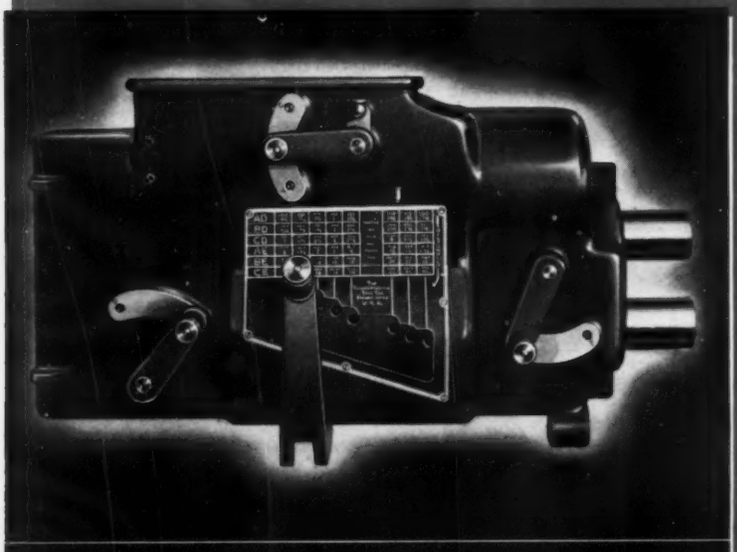
CLEVELAND, OHIO

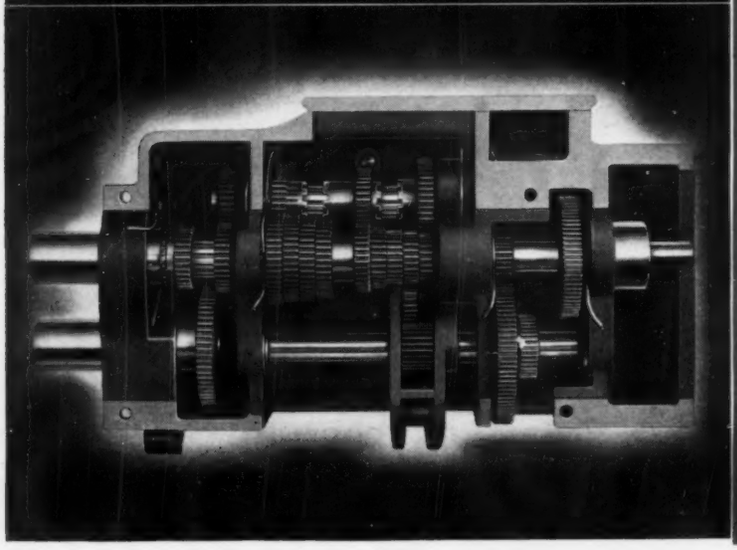
Detroit Office: 4-253 General Motors Building

FOOTBURT *Sensitive* DRILLING MACHINES



SIDNEY
THE SIDNEY MACHINE TOOL CO., SIDNEY, OHIO, U.S.A.





DESIGNED FOR SPEED . . . BUILT TO LAST . . .

Sidney Lathes

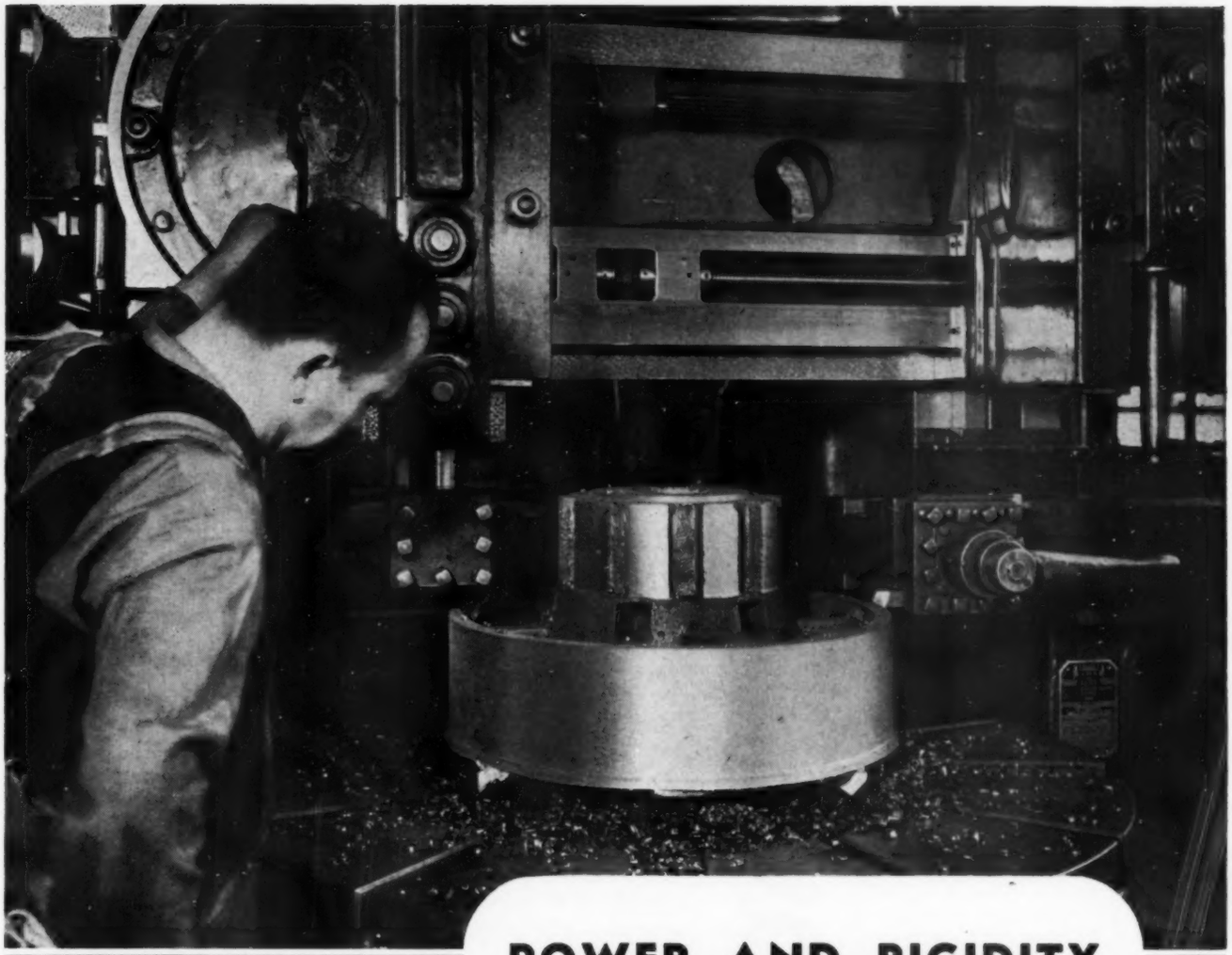
Sidney Lathes—14" to 36" capacity range—are designed to give the utmost of production — the greatest possible versatility — and long, trouble-free life. Sidney Lathes have the stamina to stand up under the unusual production of war time demands and stay on the job for years.

GEAR BOX

The Gear Combinations illustrated provide a range of 48 selective thread and feed changes. All shafts are mounted on anti-friction bearings and both shafts and gears are made of alloy steel, heat treated and hardened.

Complete bulletins on all models quickly available.

SIDNEY
MACHINE TOOL COMPANY
SIDNEY . . . OHIO . . . U. S. A.



POWER AND RIGIDITY COMBINE ON THIS JOB

to meet the close tolerances and required finish on this special alloy nickel steel casting.

Here a 26½" diameter by 5" wide drum is being turned and a 7" diameter hole 12" deep is being bored. Two set-ups were required, first rough bore inside diameter, rough and finish turn face —second finish inside bore, finish outside diameter, rough and finish opposite face.

This is typical of the way in which many jobs are being handled on King Vertical Boring & Turning Machines to speed up vital war equipment.

KING MACHINE TOOL CO.

KING BUILDS

King Vertical Boring and Turning Machines are built in single column types from 30" to 42" and double column up to 10 feet.

The KING MACHINE TOOL Company

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

CINCINNATI, OHIO

THIS IS THE STORY OF CARBOLOY

How a Most Strategic Material of the War—Invented in Germany—Was Made Available to the United Nations

★

More Precious Than Diamonds in War Production . . . Carboloy is an American trademark for cemented tungsten-carbide, an alloy second only to diamonds in hardness, more precious than diamonds as a vital material in America's war program. It is used for the tips of cutting tools, and for wear-resistant dies. Carboloy is used in small quantities; it is difficult to make and difficult to use—but it has never been scarce in modern times. There is no scarcity now.

Invented in Germany—Krupp Protected by U. S. Patents . . . Cemented carbide was invented in Germany—it belonged to Krupp of Germany, and this made all the rest of the world Krupp's customer. In this country, Krupp was protected by patent grants from the United States.

General Electric Creates Independent Production . . . The General Electric Company two years before this had begun research on tungsten-carbide and foresaw its importance in industrial production. For immediate use in its own plants and for easier availability to others, General Electric undertook the long and arduous negotiations for the American rights. Limited rights were obtained in 1928, with Krupp continuing to export the material to its United States customers—a business which languished, however, as General Electric painstakingly developed its own Carboloy technique. This paved the way for General Electric to make the United States entirely independent of Germany for its cemented tungsten-carbide supply as early as 1936.

American Tool Costs Half That of German... From the start, two totally different businesses were involved. Krupp originally exported cemented carbides in chunks—and was unsuccessful. General Electric—and its subsidiary, Carboloy Co., Inc.—found it necessary to develop a complete engineering and manufacturing service, making various types of Carboloy equipped tools, training men in their use, and offering to its customers a specialized and successful production technique. For purposes of fair comparison, a typical German cemented carbide tool in 1928 cost $22.26 in the United States, while a comparable American Carboloy tool cost $11.11.

Loss to General Electric for Many Years—Art Taught to Industry . . . In times of peace—and 1928 was such a time—the measure of success of industrial adventure is to be found in profit to the adventurer. By such a measure, Carboloy could not be called successful. Initial expenses were great. For a time the Company lost at the rate of $1000 a day, and once had an operating deficit of more than a million dollars.* One of the major contributing reasons was the continuing high cost of development, standardization, and training. In 1936–37 alone, training courses were given to 10,000 men in industry. Moreover, six major price reductions were made in the face of operating losses, until the standard tool blank had been reduced in price 90 per cent.

Faith and Perseverance . . . Depression was still another reason—labor-saving tools could not be sold to industry or labor at any price. But General Electric, with determination that now seems providential, kept on—increasing its capacity, granting new licenses, condoning instances of unlicensed production, staying ahead of its market.

Production Multiplied Forty-five Times in Four Years . . . Cemented tungsten-carbide could easily have been a source of weakness here, as it was in England, had it not been for General Electric's policy of continued expansion. In 1939, the production of the Carboloy Company was less than 20,000 lbs.; in 1940, it was 55,000 lbs.; in 1941, it was 163,000—and in December came Pearl Harbor. Now, in 1942, the Company's production is going at a rate that is 45 times that of only four years ago.

Britain Dependent upon Us . . . By contrast, British companies, which had been content to continue as customers of Krupp, found themselves cut off from the vital material when Poland was invaded. But the General Electric Company was able to supply substantial quantities to British industry immediately and since then has continuously filled British orders. It has, in like manner, filled Canada's requirements since 1936. It is currently supplying Canada, Russia, and other United Nations. All this in addition to supplying the greatly expanded needs of American industry.

An Inspirational Story of American Industry . . . Thus, the story of Carboloy does not end in "too little and too late." Like many previously untold stories of American industry, it continues, a sturdy and inspiring example of public service born of private enterprise, and characterized by hard work, ingenuity, investment, research, risk, and courage—a familiar pattern on this side of the Atlantic. *General Electric Company, Schenectady, New York.*

**Over the entire period of its existence up to January 1st, 1942, the total net profit of the Carboloy Company was 2.5 per cent of sales.*

GENERAL ELECTRIC

952-325

This CLEARING Press has been designed and built for the intricate and tremendously important job of making propellers at high speeds. Having a capacity of 4000 tons, this Press operates at the extremely rapid rate of 75 strokes per minute. For feeding the propeller tube longitudinally into the press dies the Press is equipped with a feeding carriage well guided on a supporting bed. Operated hydraulically from pump plungers actuated by the Press drive, thus giving perfect timing between the Press motion and the feeding movement of the carriage.

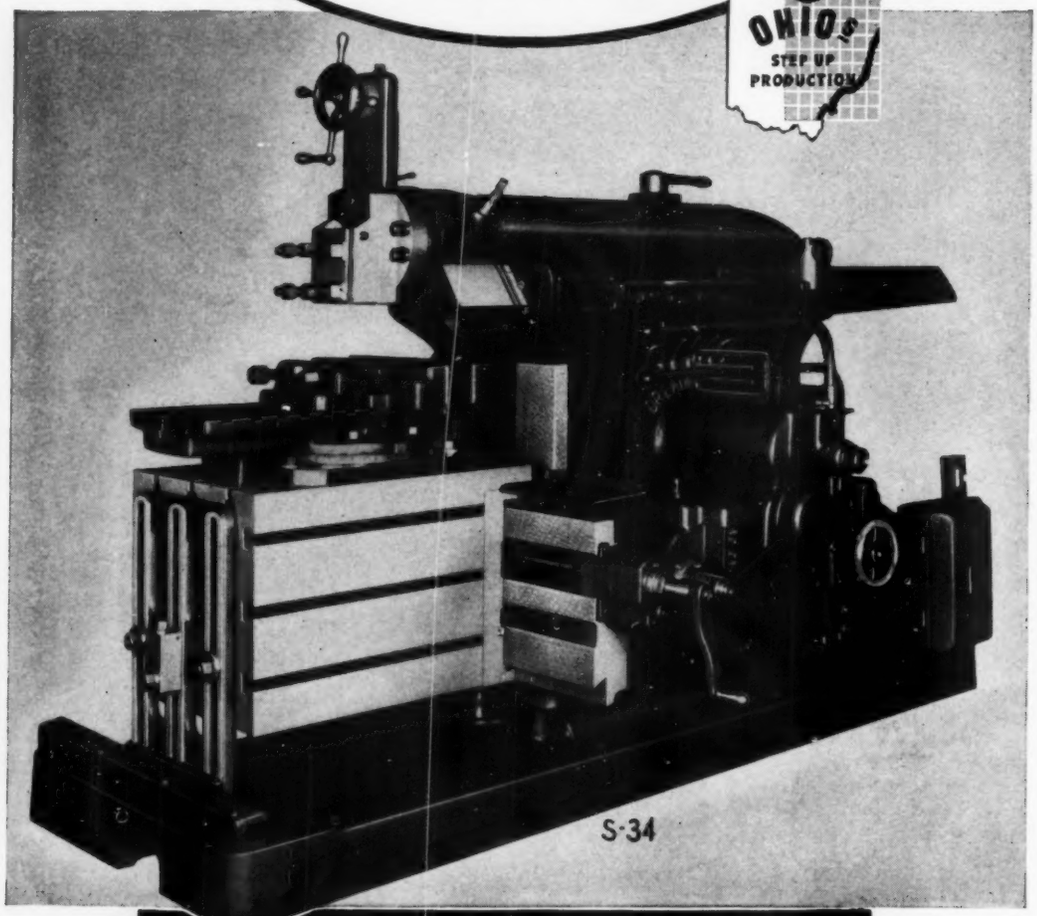
CLEARING Mechanical and Hydraulic Presses exemplify the engineering genius of our United States.

CLEARING MACHINE CORPORATION
6499 WEST 65TH STREET, CHICAGO, ILLINOIS

MECHANICAL AND HYDRAULIC PRESSES

CLEARING
MACHINE CORPORATION
CHICAGO

OHIO DREADNAUGHT SHAPERS

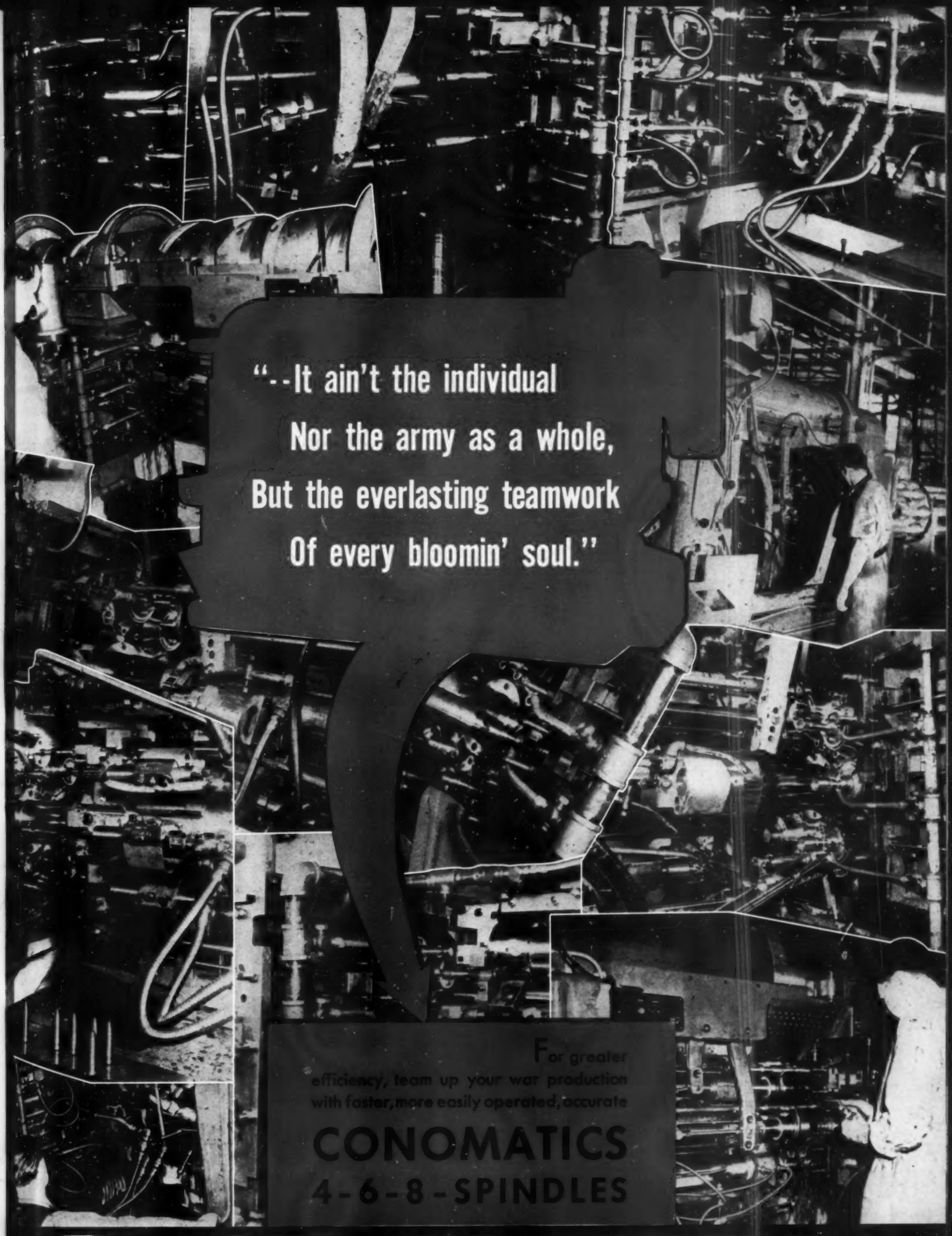


Ohio Dreadnaught Shapers answer the call for top production with ample power, heavy duty construction and reserve capacity, which enable them to machine bigger and bigger parts and more and more of them . . . One-position control makes operation easy. Inbuilt rigidity and accuracy promote fast, accurate work . . . Many accessories and attachments meet specific requirements.

THE OHIO MACHINE TOOL COMPANY
KENTON • OHIO

Orders for Ohio Production Milling Machines are being shipped promptly.

OHIO DREADNAUGHT
HORIZONTAL BORING, DRILLING AND MILLING MACHINES • SHAPERS • PLANERS


"--It ain't the individual
Nor the army as a whole,
But the everlasting teamwork
Of every bloomin' soul."
For greater efficiency, team up your war production with faster, more easily operated, accurate
CONOMATICS
4-6-8-SPINDLES

CONE AUTOMATIC MACHINE CO., Inc.

WINDSOR, VERMONT

NO WARP IN THE THIN SECTIONS

PEP UP PRODUCTION AND YOU STEP UP VICTORY

Start using Graphitic Steel now—and increase your war production. Continue using it after Victory—and fortify yourself against post-war competitive conditions.

TO ASSURE VICTORY
BUY UNITED STATES DEFENSE BONDS & STAMPS

Mr. E. P. Rupprecht, Superintendent of The Chicago-Wilcox Manufacturing Company, Chicago, Ill., reports "We used to have considerable trouble with warpage in the thin sections of our intricate gasket dies. Graph-Mo steel has solved that problem and made our work a lot easier in other ways, too. Graph-Mo machines much easier than other die steels we've used and wears longer."

This is just one of the hundreds of testimonials pouring in from users of this remarkable new die steel.

Ask for your copy of the Graphitic Defense Handbook. It will answer all your questions about this steel.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO
Steel and Tube Division

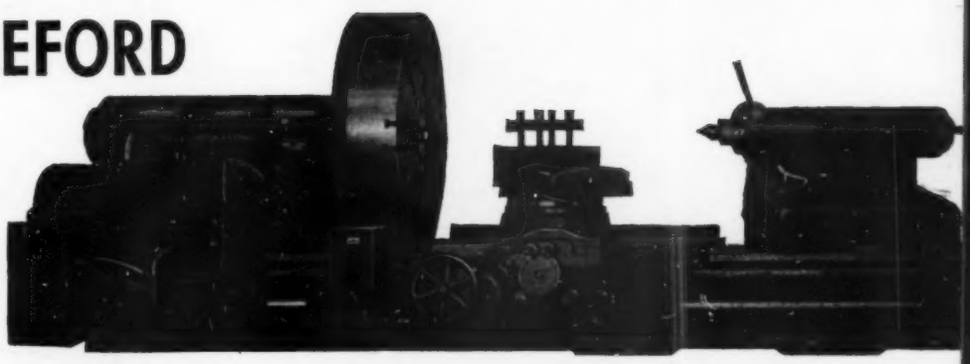
TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
GRAPHITIC STEELS

Manufacturers of Timken-Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

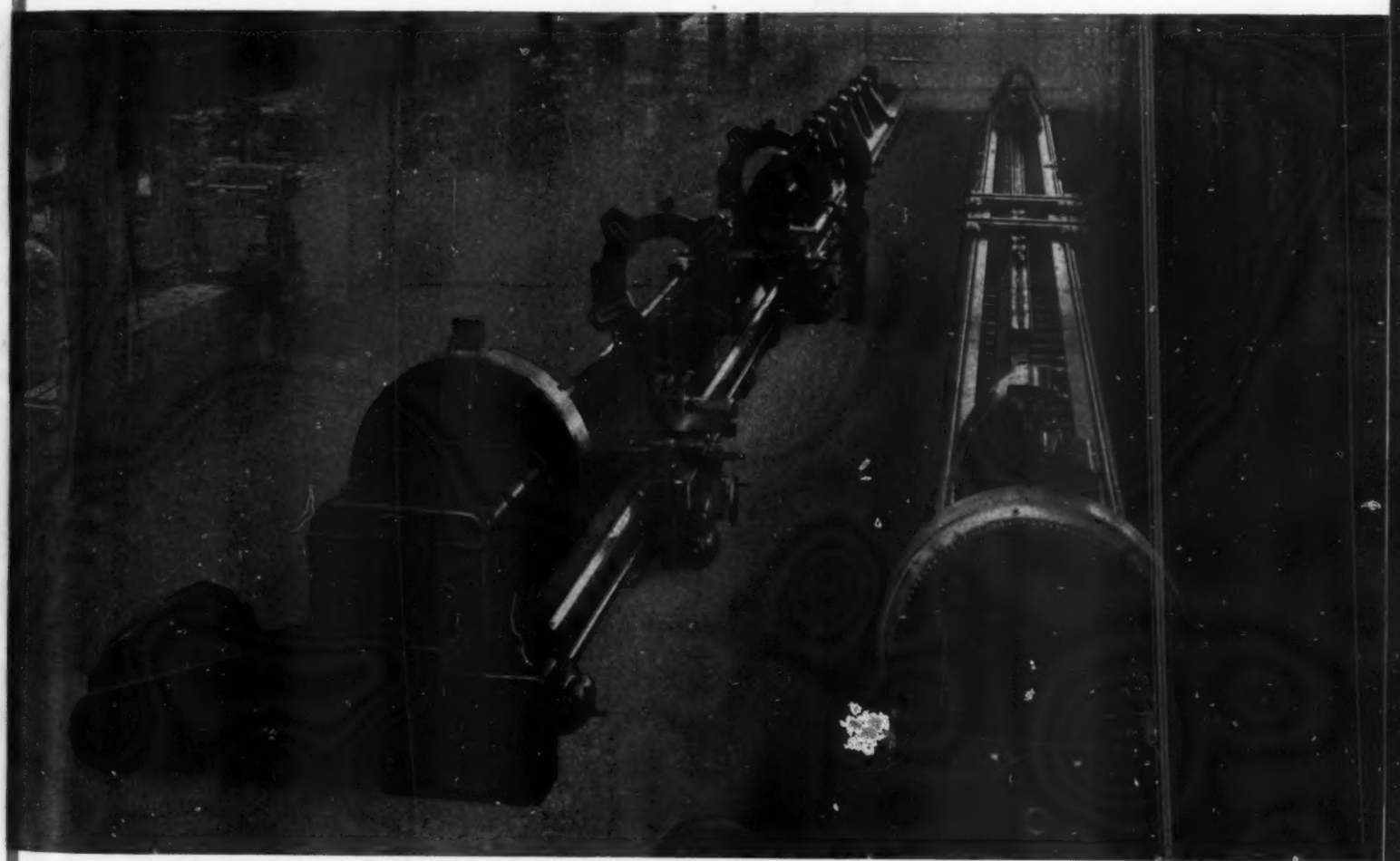
Big Lathes

BETTS-BRIDGEFORD

A NAME UNIVERSALLY RECOGNIZED AS A LEADER IN MEDIUM AND LARGE ENGINE LATHES FOR FAST AND ECONOMICAL PRODUCTION

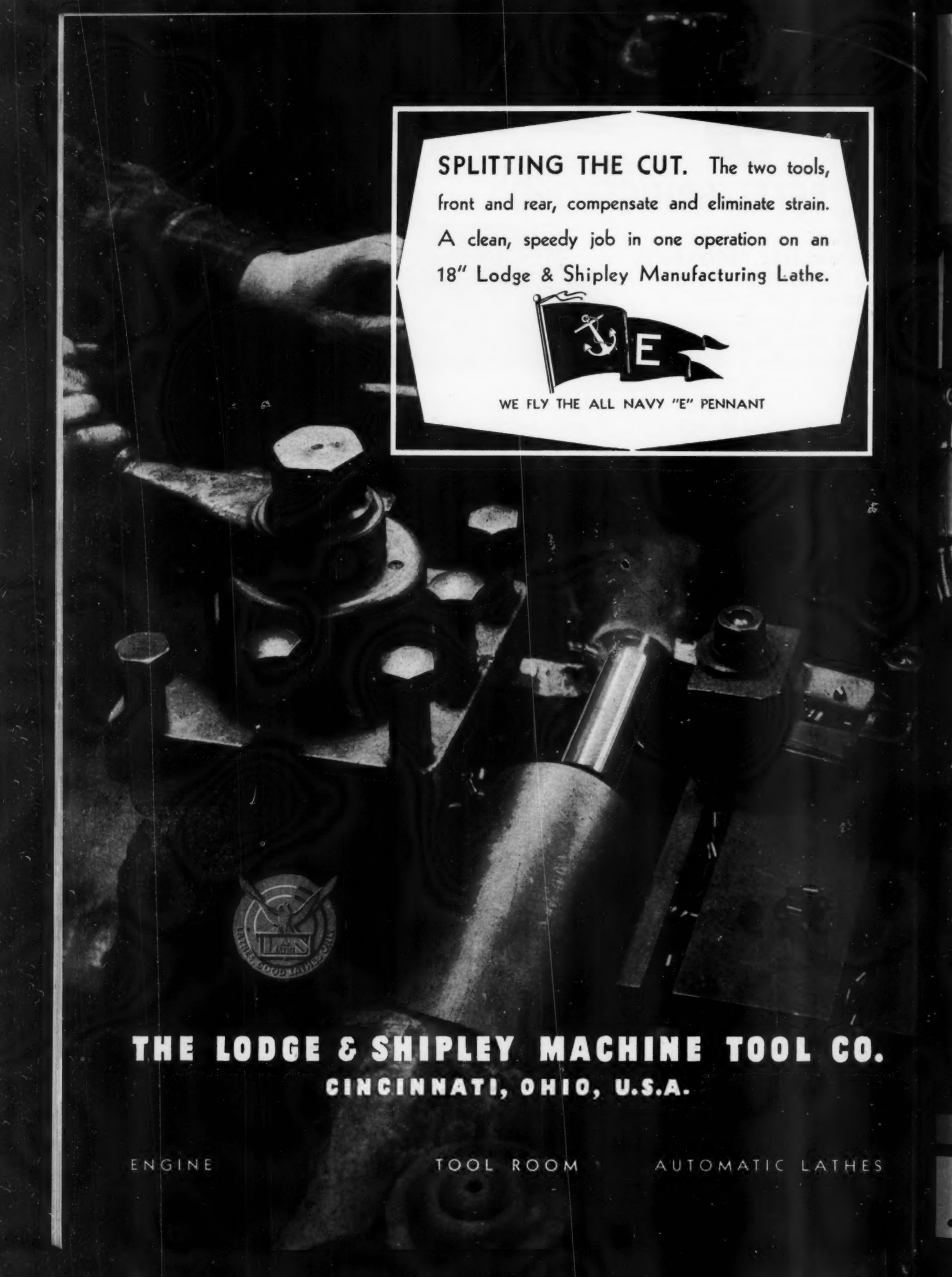


Today these Betts-Bridgeford Lathes have the same rugged dependability as in past years and in addition they have every modern improvement for convenience of operation and speed in production. Where the work is heavy and requirements call for accuracy and speed, it will pay you to look into the help these Lathes can give you.



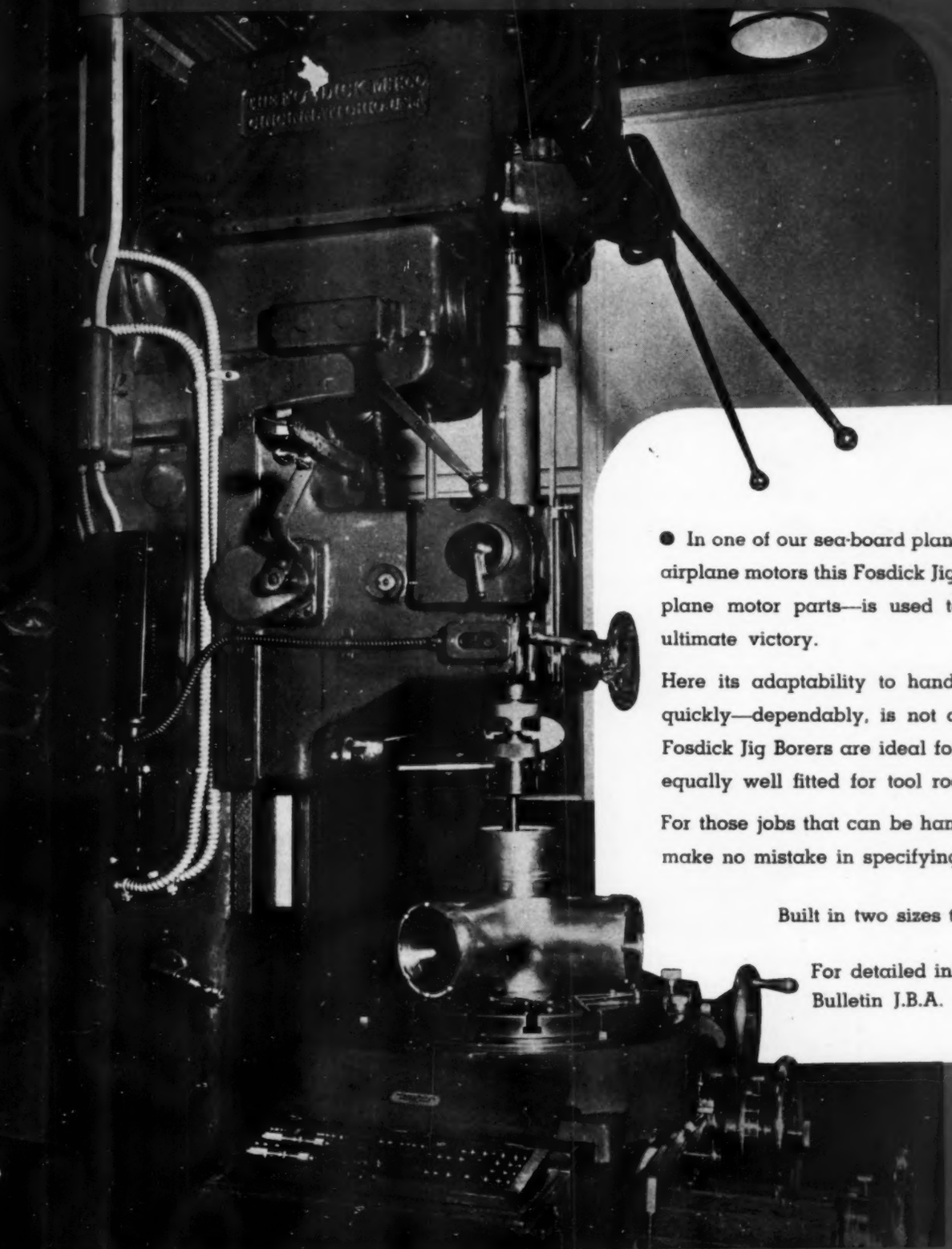
BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK


SPLITTING THE CUT. The two tools, front and rear, compensate and eliminate strain. A clean, speedy job in one operation on an 18" Lodge & Shipley Manufacturing Lathe.
E
WE FLY THE ALL NAVY "E" PENNANT
THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U.S.A.
ENGINE
TOOL ROOM
AUTOMATIC LATHES

FOSDICK *Jig Borer*

HELPS KEEP 'EM FLYING



● In one of our sea-board plants engaged in manufacturing airplane motors this Fosdick Jig Borer is used to produce airplane motor parts—is used to help keep 'em flying for ultimate victory.

Here its adaptability to handling close tolerance work—quickly—dependably, is not only essential but profitable. Fosdick Jig Borers are ideal for this production job and are equally well fitted for tool room operations.

For those jobs that can be handled on a Jig Borer you will make no mistake in specifying Fosdick.

Built in two sizes the 30 and 30-A.

For detailed information, write for Jig Borer Bulletin J.B.A.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI ... OHIO

"PUT IT ON THE BLANCHARD"

BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ Predirection

★ Adaptability

Fixture Saving

★ Operation Saving

Material Saving

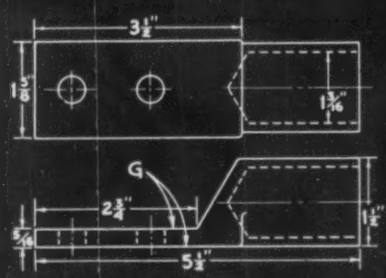
Fine Finish

Flatness

Close Limits

★

. . . Especially valuable on jobs like the one illustrated.



Courtesy of CARPENTER MFG. CO.

Less Than

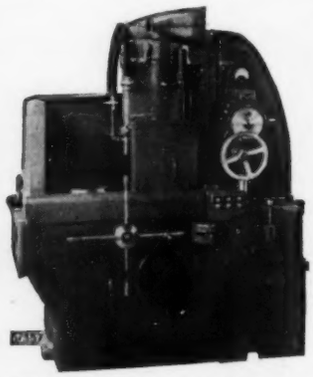
TWO MINUTES EACH

THESE copper lugs for large cable are ground on both sides on a No. 11 Blanchard Surface Grinder in Blanchard designed fixtures.

Both sides of the castings are ground to clean up — to close limits for parallelism. The floor to floor time is less than two minutes each.

This is a good example of work with a projecting surface that can be ground to advantage on a Blanchard. This is accomplished by mounting the lugs in the fixtures with the round end toward the center of the chuck. The chuck is moved under the wheel to the proper depth and then the wheel is fed down until all the surfaces on one side are ground clean. The same method is used for grinding the surfaces on the other side.

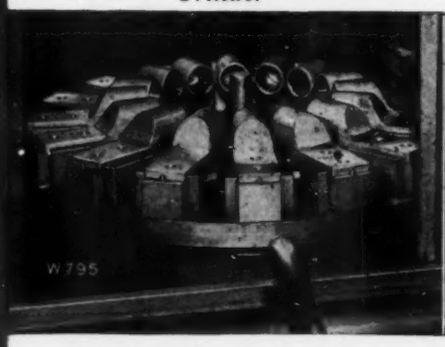
Whether your work requires fine finish or extreme accuracy — whether it requires light finishing cuts or hogging cuts, the Blanchard No. 11 will do the job quickly and economically.



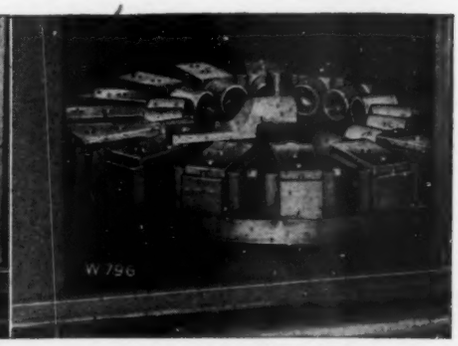
Blanchard No. 11 Surface Grinder

BLANCHARD
MACHINE COMPANY
64 STATE ST., CAMBRIDGE, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.



Grinding offset side of lugs



Grinding flat side of lugs

STANDARD
Dial Snap Gages

"CONVOY YOUR PARTS THRU PRODUCTION"

STANDARD GAGE CO., INC.
POUGHKEEPSIE, NEW YORK

Twist Drills—Milling Cutters —Reamers—Hobs—Slittings Saws—End Mills—Taps—Dies —Screw Plates—Profile Cutters—

THE TOOLS YOU BUY AGAIN

EVERY SMALL TOOL JOB IS AN OPPORTUNITY FOR A SAVING

Completeness of the UNION line makes it possible to realize BIG SAVINGS on many operations. Milling, drilling, reaming, hobbing, slitting, tapping, threading, cutting can be speeded up and costs reduced by these modern, fast, accurate tools.

Cost minded production men know from experience that UNION tools can always be depended on for economy and increased cutting efficiency over long periods between grindings.

Because of the wide range of tools in the UNION line, with each tool designed for maximum results, standardization on UNION tools can mean an overall total saving of substantial proportions. Put UNION tools to work and see for yourself.

UNION
TWIST DRILL COMPANY
Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 6540 Antoine St.

MANUFACTURING DIVISIONS
S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island. Quebec

Representatives throughout the world

UNION

TODAY'S TOUGH JOBS CALL FOR TRI-CLAD MOTORS

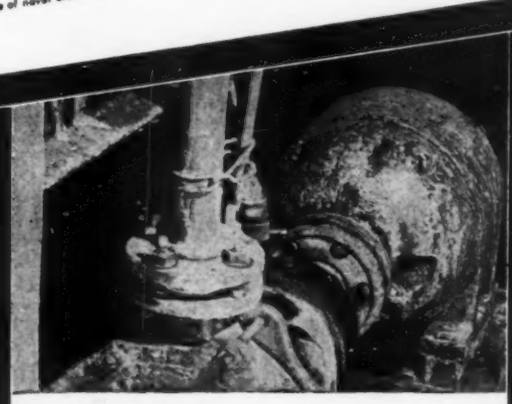
REG. U.S. PAT. OFF.

TODAY, you must be sure the motors you buy will give you 24-hour operation, even on the *tough* jobs. Here's where the Tri-Clad motor becomes a real asset. Its cast-iron frame and end shields are a safe-guard against accidental blows. The stator winding is protected against damage from oil, moisture, and heat shock. Improved bearings are enclosed in cast iron, protected against the entry of dust or dirt. Ask your G-E representative for details on types and sizes now available, or write General Electric Company, Schenectady, N. Y.

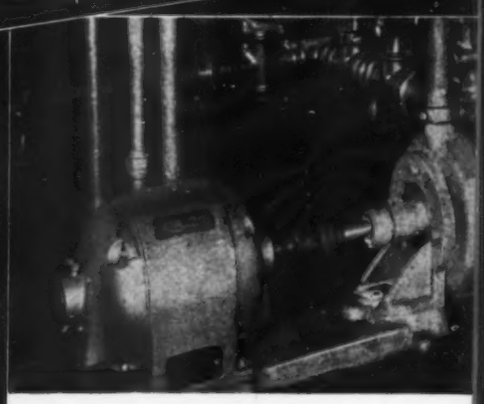
Now available up to 100 HP in standard, open construction

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

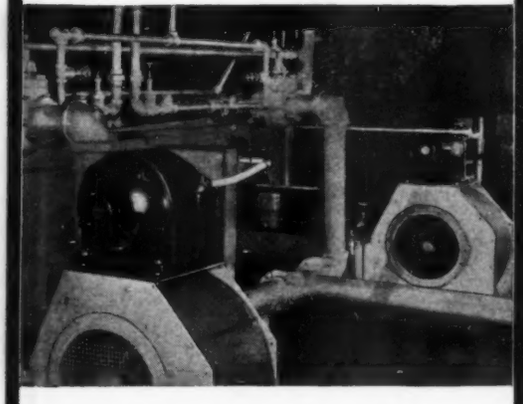
BIG JOB On machines vital to the war effort, Tri-Clad motors are well guarded by their cast-iron frames from metal chips or dripping coolants.



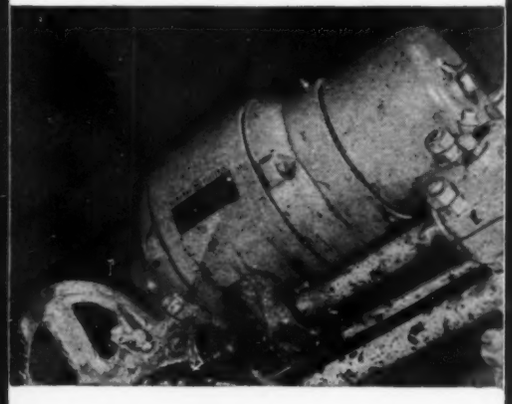
DIRTY JOB Note how dust and fumes have coated this Tri-Clad ball-bearing motor. This is service for which we might not recommend open motors, such as that shown, but we are glad to chalk up this instance of motor stamina under severe operating conditions.



WET JOB Here's a Tri-Clad splash-proof motor close to the floor. Special end shields, watertight conduit boxes, and Formex wire give it *extra* protection against moisture.



HOT JOB These stoker motors are down where red-faced firemen used to sweat. Double-end ventilation and Formex windings with high-heat-transfer advantages give it *extra* protection needed for this service.



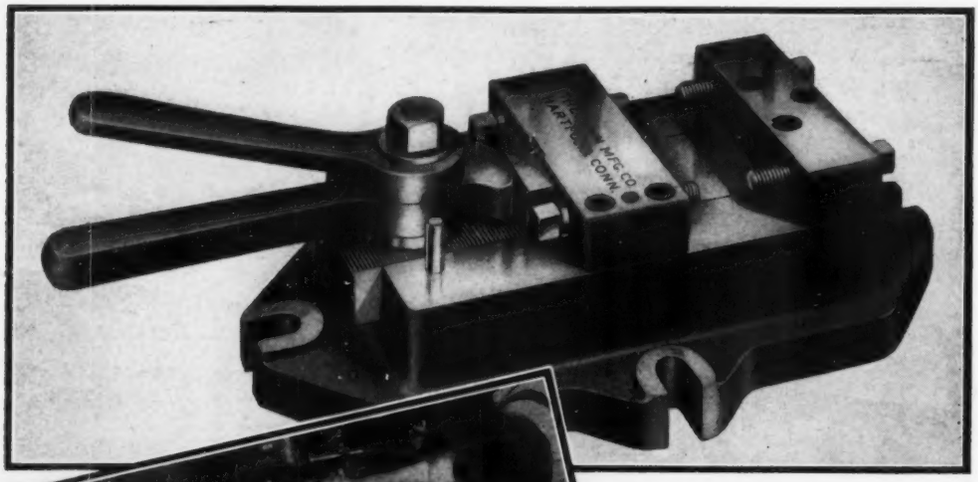
HEAVY JOB This Tri-Clad motor is installed on a lift bridge. In these surroundings where grease and grime are ever present, a protective frame is an important factor in continuous operation.

RUSH JOB Here's a Tri-Clad moto at work in the arms industry. The many feature of Tri-Clad motors can not only help plants t get important tools into production quickl but will also help keep them in triple-shi operation.

GENERAL ELECTRIC

750-115-8068

Don't Take Our Word for It. Prove to yourself by an actual test in your own plant that you can mill, drill, tap and assemble faster with a FENN



FENN QUICK ACTION VISES

for small parts production

Rugged, high speed service on all milling, drilling, tapping and assembling operations. Just the vise for holding small parts used in airplanes, machine guns, jeeps, tanks, precision instruments, refrigeration, electrical equipment, tool making, etc.

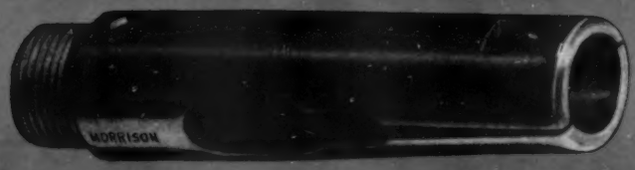
We will be pleased to send a Vise to anyone in your Company for inspection and to study its adaptability to your production requirements. No obligation whatever. Prove its performance on the job. The FENN can be depended upon to give long, dependable service. You will find that operators enjoy working with it because it saves time and fussing.

Write today for descriptive Bulletin No. 10

FENN

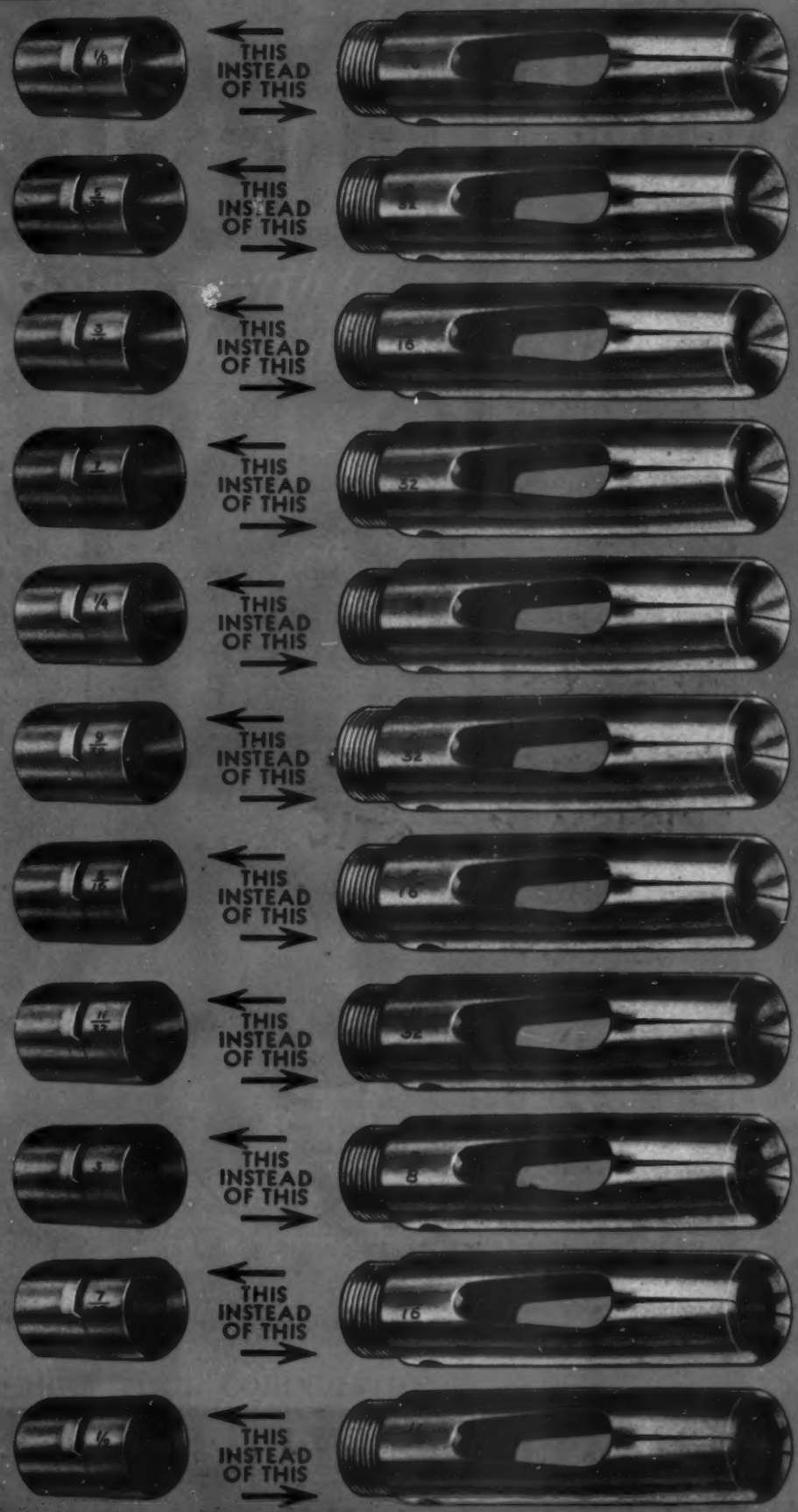
THE FENN MANUFACTURING CO.

HARTFORD, CONNECTICUT • ESTABLISHED 1900



MORRISON
Style "B"

Save Material



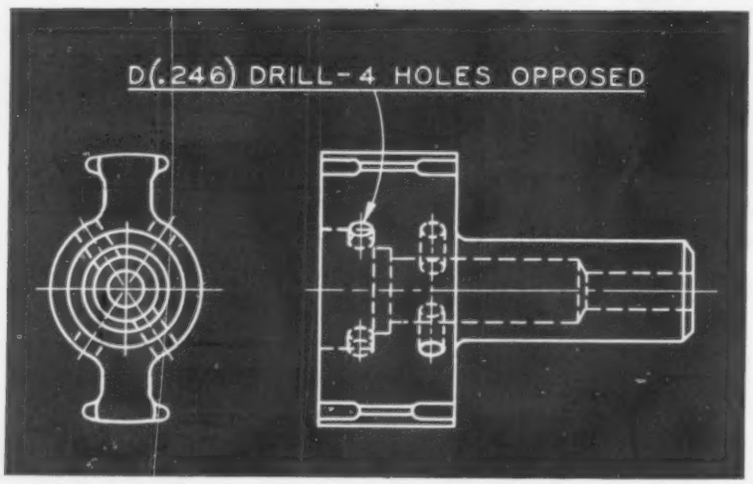
HARDINGE BROTHERS, Inc., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

There are 2 ways to do this job—

1. The EXPENSIVE WAY... or

2. The FLEXIMATIC by KINGSBURY



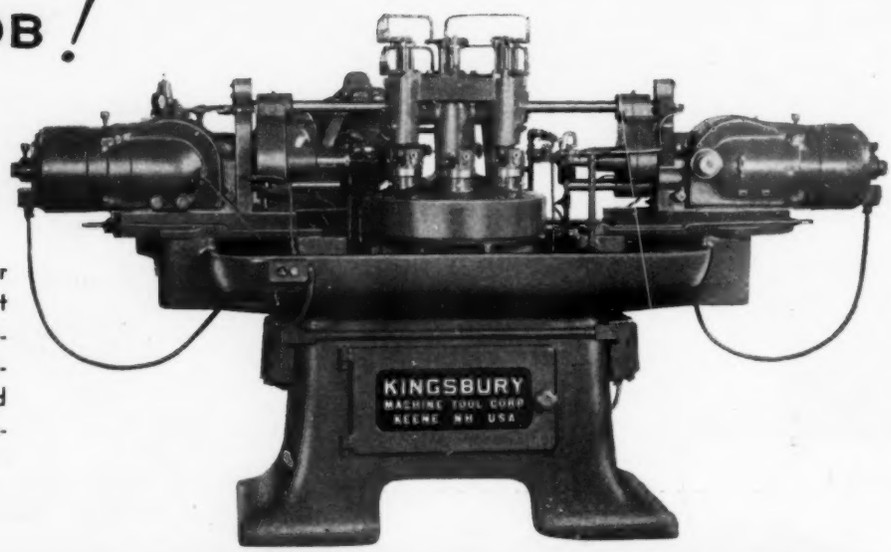
WAY

The expensive way to drill the four opposed holes in this shock absorber part would be to use a general-purpose drilling machine. Production would be limited to one hole at a time and by operator skill in manual indexing, etc.

The FLEXIMATIC way uses standard Units set up on a standard base around an automatically indexing turret. The only manual operations are loading and unloading, and even as these are being performed the Units are drilling work already loaded.

FLEXIMATICS combine the speed and efficiency of a special purpose machine with the valuable advantages obtained by their flexible set-up.

Standard Kingsbury Units for drilling, reaming, boring, spot facing and many milling operations may be mounted in any combination on standard bases and readily changed over to manufacture a wide variety of parts.



KINGSBURY MACHINE TOOL CORPORATION
KEENE NEW HAMPSHIRE U S A

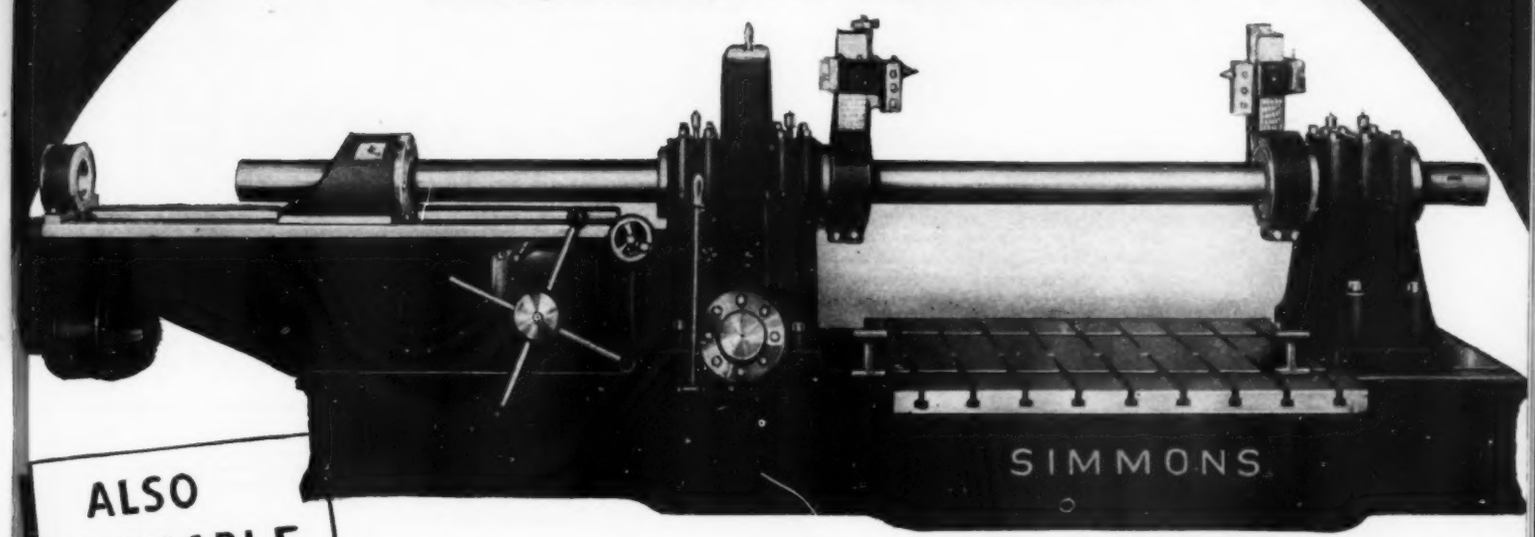
NO WAITING!

6" BAR HORIZONTAL BORING AND FACING MACHINE

Immediate Shipment with 17' Boring Bar
30 Day Delivery of Machine with 24' Bar

SPECIFICATIONS

Diameter, Boring Bar	6"
Travel of bar in one setting	60"
Capacity of facing heads	9" to 38½"
Widened portion of bed	51½" x 68", 18" High



ALSO AVAILABLE WITHOUT CENTER SECTION OF BED

This new Simmons 6" Bar Horizontal Cylinder Boring and Facing Machine is ideal for current War Production requirements. The bed, which is of massive construction, is heavily ribbed to insure maintained alignment.

Equipped with Simmons Micro-Feed Unit, an infinitely variable transmission, this boring machine offers both fine and coarse feeds ranging from .004" to 1.000" per revolution of spindle. The main drive to the boring bar is obtained through a six-speed gear box, motor-driven. Gears are of high-carbon steel and mounted on spline shafts with anti-friction bearings running in oil. Power Rapid Traverse to bar in both directions.

Write TODAY for Descriptive Bulletin.

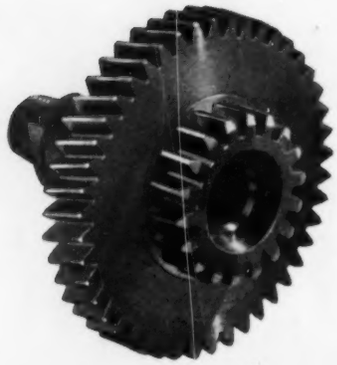
SIMMONS MACHINE TOOL CORPORATION

1759 North Broadway, Albany, N. Y. New York City Office: 149 Broadway

SIMMONS

MICRO-SPEED
REG U.S. PAT. OFF.

LATHES • TURRET LATHES • MILLERS • PLANERS • 6" BAR BORING MACHINES



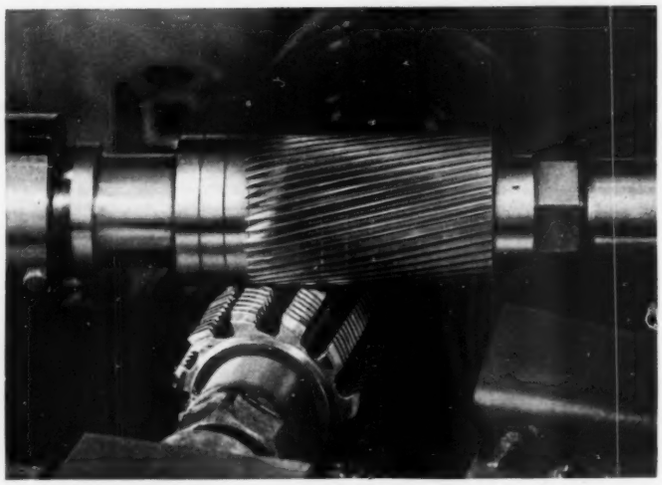
These tiny brass drive gears require accuracy and fine finish for quiet, smooth running operation, yet they must be produced in quantity and at low cost. Both of these desired conditions are obtained on this B-C No. 3 Hobbing Machine.

.0002" KICKOUT
.001" ECCENTRICITY

PRODUCTION *and* PRECISION

ON A BARBER-COLMAN NO. 3 HOBBING MACHINE

THE smaller gear on shaft is hobbed in another operation. The larger gear is hobbed in loads of thirteen, and then pressed on the shaft carrying the smaller gear. A highly accurate job is being done on a *standard* Barber-Colman No. 3 Hobbing Machine. The only change on the machine is the use of a high speed hob swivel, to obtain a finer finish. A factor which contributes also to this accuracy, is the use of a taper hob spindle, and taper-hole ground hobs.



These operation pictures show how the blanks are mounted on a "quick-change" arbor, held in long sleeves at both ends. A special lever releases the tail stock sleeve. In the picture above, notice the fine finish obtained as a result of the high hob speed.

DATA ON THIS PIECE AND SET-UP

Name of Part — Small Brass Drive Gear.

Material — Soft brass.

Description — 45 teeth, 53.-2509 pitch, 12° 26'-30" L.H. helix, diameter .914", face .149".

Arbor load — 13 pieces.

Finished in one cut, conventional.

Hob Speed — 800 r.p.m.

Feed — .024" per rev. of work.

Production — 104 per hour.

Accuracy — kickout .0000" +.0002", eccentricity within .001".

Hob — B-C 1-1/4" x 1" x 5/8" taper hole, ground, single thread.

Machine — B-C No. 3, with Taper Hob Spindle and High Speed Hob Swivel.

FURTHER INFORMATION

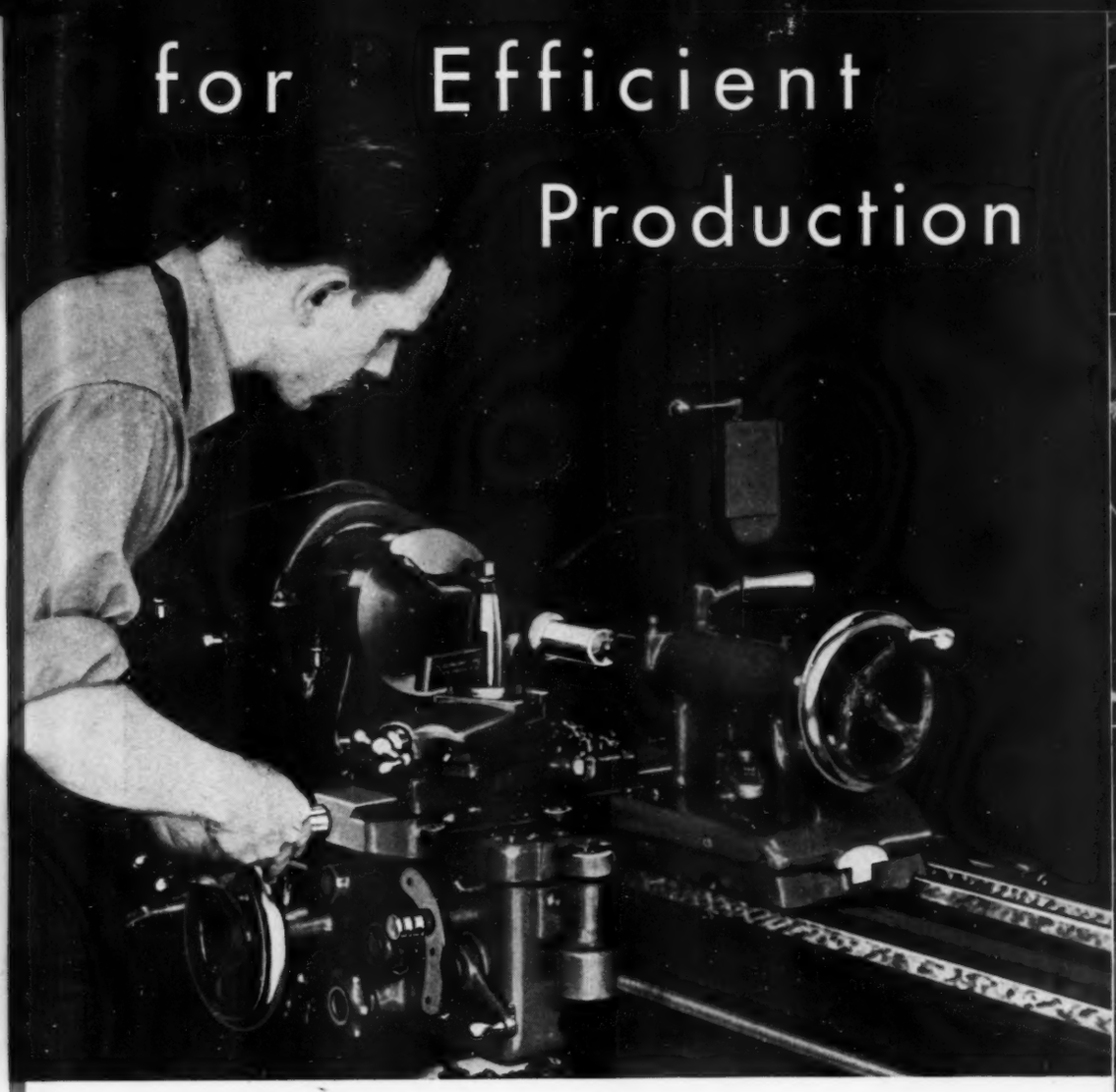
on the Barber-Colman No. 3 Hobbing Machine and its applicability to a wide variety of small and medium size work may be obtained from your Barber-Colman representative, or from the main office at Rockford. Write for bulletin F812-5.

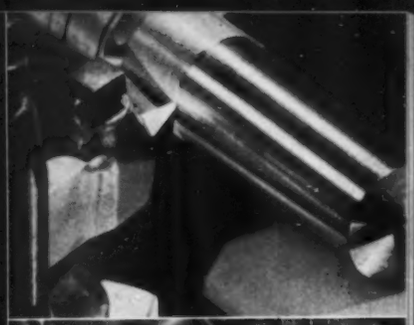
BARBER B-C COLMAN PRODUCTS
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

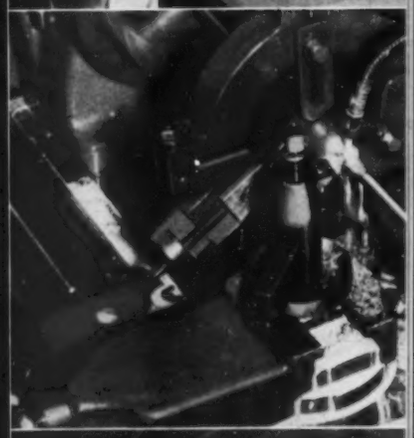
BARBER-COLMAN COMPANY

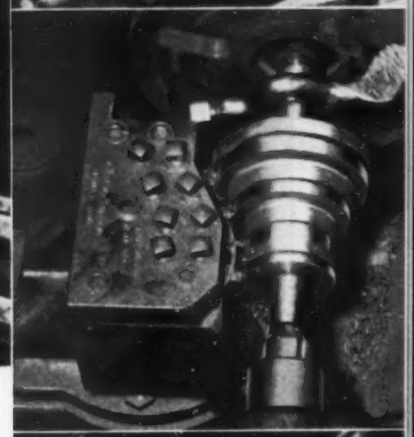
General Offices and Plant 201 Loomis Street, Rockford, Illinois, U. S. A.

for Efficient Production









SOUTH BEND LATHES

EQUALLY EFFICIENT on precision toolroom work or close tolerance manufacturing operations, South Bend Lathes will help solve your production problems. Hundreds of nationally known manufacturers select them when streamlining their shop equipment to meet present day needs. Substantial savings in capital investment, power consumption, floor space and labor costs have resulted from their installation. They will give you the same efficient, trouble-free service they are giving in the shops of some of the largest defense industries, the Army, and the Navy.

Many features contribute to the efficiency of South Bend Lathes. A wide range of spindle speeds permits machining work with maximum cutting tool efficiency. Their versatility reduces set-up time to a minimum — lowers cost of change-over from one job to another. Smooth, vibration-free operation permits finish turning or boring with such precision that subsequent grinding, honing or lapping operations can often be eliminated. A convenient arrangement of controls makes for an ease of operation which reduces fatigue and lowers the possibility of error.

Maximum production at minimum cost can be attained only when the lathe is matched perfectly with the job. Made in a wide range of sizes and types, there is a South Bend Lathe that will efficiently handle almost any class of lathe work. Write for catalog and name of dealer nearest you.

TRADE MARK SOUTH BEND ENGINE LATHES

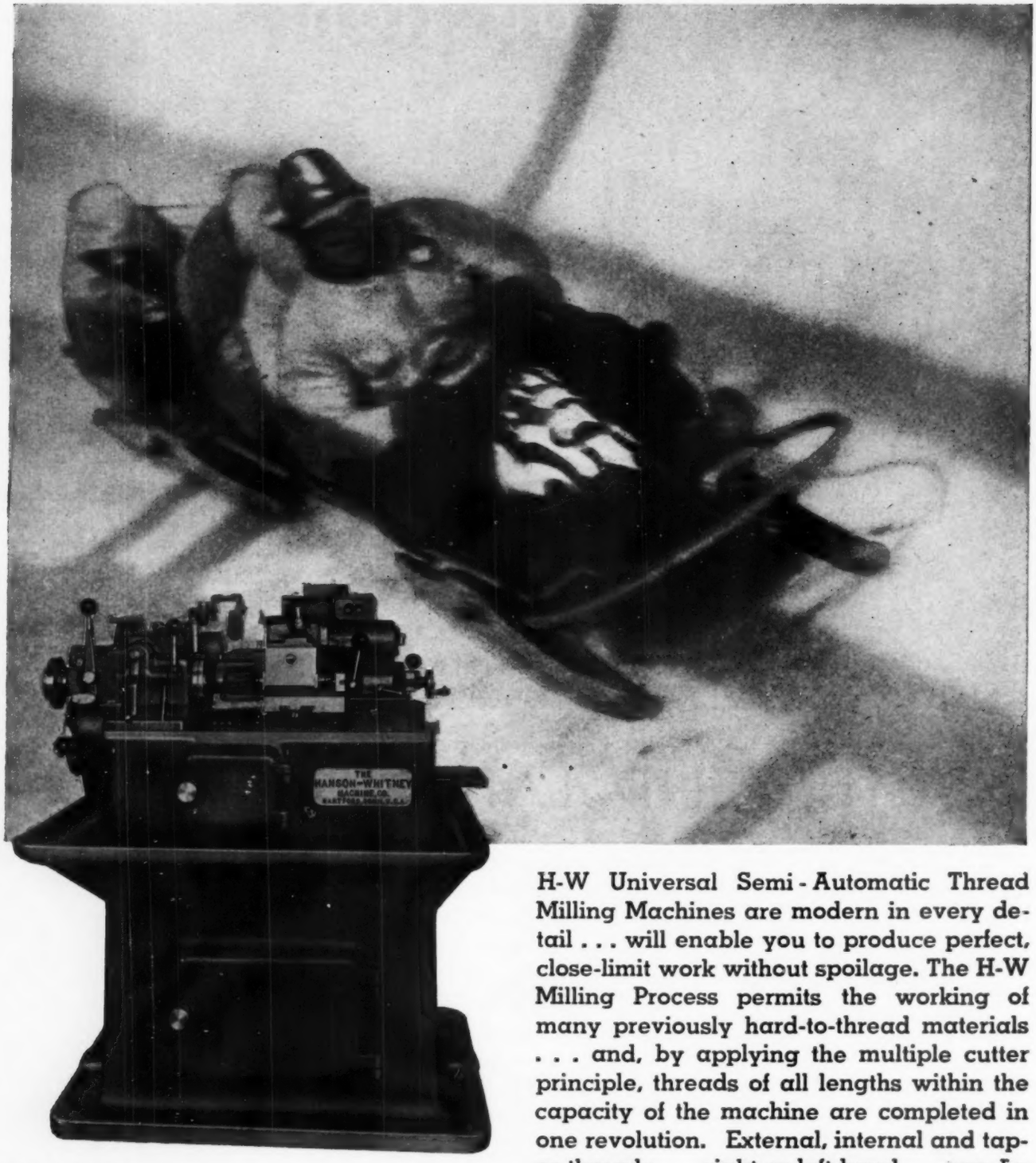
LET'S GO! U.S.A. KEEP 'EM FLYING!

SOUTH BEND LATHE WORKS

Lathe Builders For 35 Years

279 East Madison Street South Bend, Indiana, U. S. A.

speed PLUS ACCURACY . . .

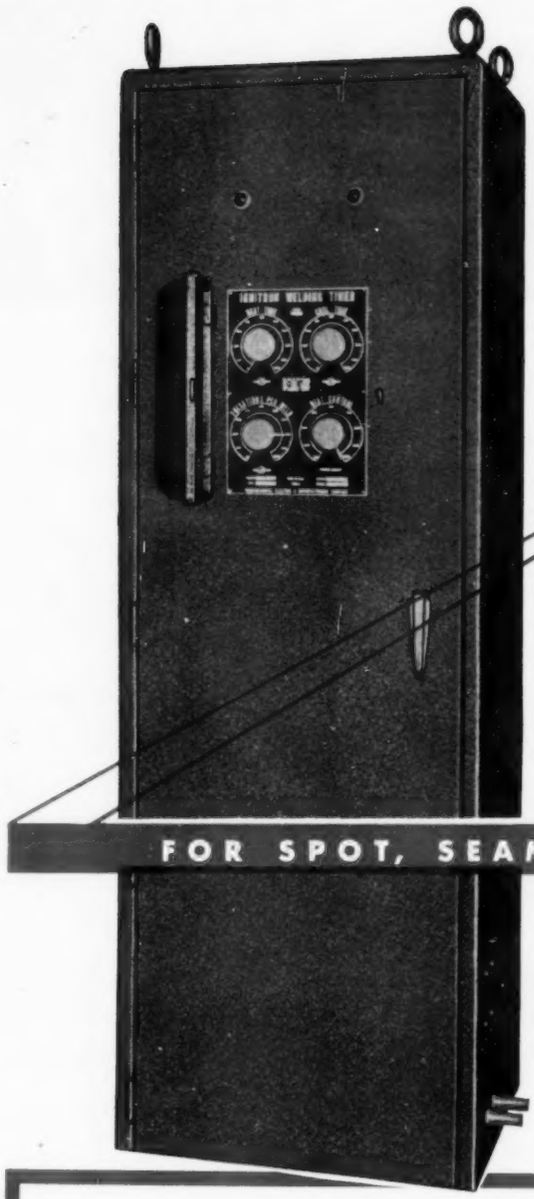


Hanson - Whitney 4 x 9"
Semi-Automatic Thread
Milling Machine.

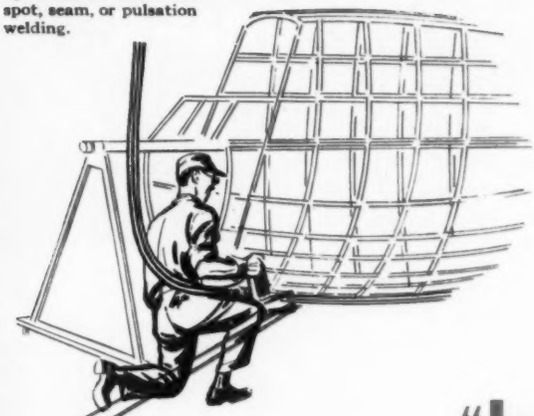
H-W Universal Semi - Automatic Thread Milling Machines are modern in every detail . . . will enable you to produce perfect, close-limit work without spoilage. The H-W Milling Process permits the working of many previously hard-to-thread materials . . . and, by applying the multiple cutter principle, threads of all lengths within the capacity of the machine are completed in one revolution. External, internal and taper threads . . . right or left hand . . . can be cut with equally high speed, precision accuracy and convenience. If you have a threading problem call Hanson-Whitney.

The HANSON-WHITNEY MACHINE CO

HARTFORD CONN., U.S.A.



Timer illustrated is a Type SX Combination Synchronous Timer for spot, seam, or pulsation welding.



NO MORE "burned" OR "cold" SHORT-TIME WELDS WITH

Westinghouse Synchronous Timers

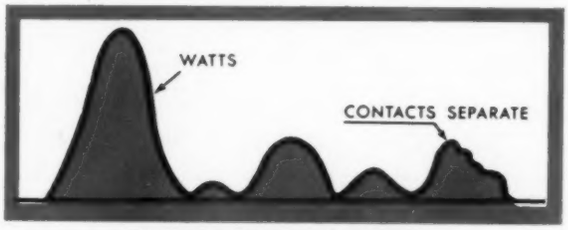
FOR SPOT, SEAM OR PULSATION WELDING

Where welding time of a few cycles only is required for critical metals and small parts, random (nonsynchronous) switching seriously affects the quality of the weld. This is because initial surge currents can cause as much as 50% variation in the heat produced in a weld — producing either a warped, burned, or weak, cold weld.

Westinghouse Synchronous Timers eliminate unpredictable "transients" or current surges by always starting and stopping the weld current at the zero point on the current wave, or later (when heat control is used). As a result, each weld duplicates the quality of the preceding one because the wave form is the same.

These timers make possible a rigorous system of quality control that insures consistent welding of critical alloys and thin materials. Stainless steel, for example, can be welded without loss of stainless properties. Discoloration and electrode "pick-up" can be reduced. Investigate the possibilities of Westinghouse Electronic Control for your resistance welders. Ask your Westinghouse Representative for Booklet B-3102. Or write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-21223

SYNCHRONOUS TIMING
Starting and stopping at zero point produce even wave form—uniform "heat".



NONSYNCHRONOUS TIMING
Random (nonsynchronous) switching may produce this wave form — unpredictable "heat".

Westinghouse

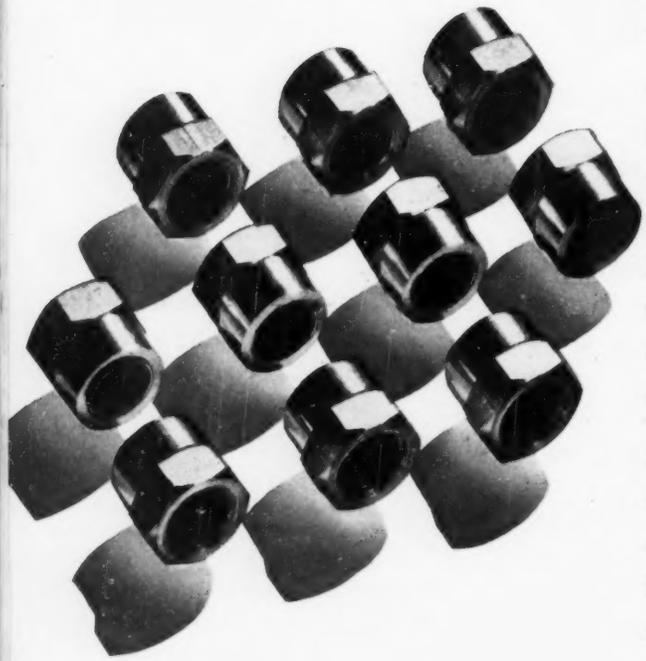
RESISTANCE WELDING CONTROL

CLARK CONTROLLER COMPANY

BREAKS "Bottle-necks"

WITH SMALL LOTS, SHORT RUNS

LET'S GO! U.S.A. · KEEP 'EM FLYING!



• With literally a thousand-and-one electrical control devices to manufacture for almost as many industrial customers, each of which requires its own highly specialized application made-to-order—Clark Controller Company relies on Cleveland Model A *Single Spindle* Automatics for *small lots and short runs* of a variety of parts.

Small lots and short runs of such parts as those shown below at left to meet the rising tide of high priority orders is the rule—*not the exception,* and the quick tooling-up features, the ready accessibility of Model A for adjustments, makes them extremely versatile machines to operate as well as highly economical.

One lot of control devices of extreme precision workmanship may follow another lot of electrical devices for an entirely different purpose, but in quantities of 200 to 500 pieces it is very economical of time, money and effort to set up for such jobs on a Cleveland Model A machine. Operators like Clevelands for that reason because they can average more pieces per hour—and there is little down-time for machine casualties because Clevelands are built sturdily and dependably to stand up under extreme service demands.

Here a battery of 1 1/16-inch capacity Model A machines were crowded a little closer together to add a new one recently, and production goes on at top speed with skillful operators just old enough to vote! Ask for information about application of Clevelands to your *short run, small lot* production.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

2269 ASHLAND ROAD · CLEVELAND, OHIO

Sales Offices: NEWARK—15 Washington Street · DETROIT—540 New Center Bldg.
CHICAGO—565 West Washington Street · CINCINNATI—507 American Building

RELEASED FOR PUBLICATION BY NAVY DEPARTMENT

★ ★ ★ ★ ★ ★ ★

Consider **Cleveland *Single Spindle* Automatics if you make duplicate parts in small quantities. By using *single spindle* automatics the increased production obtained from them may release a number of other critical machine tools for other purposes.**

An 8-inch capacity Cleveland *Single Spindle* Automatic, Model A, makes parts for the "Pacemaker", newest American lathe; at greatly reduced costs over previous methods, for American Tool Works Company.

Three of 26 Model B Cleveland *Single Spindle* Automatics used by Packard Motor Car Company in Rolls-Royce aircraft engine parts production.

One of the 2½-inch Cleveland Model A *Single Spindle* Automatics producing locomotive stay bolt sleeves for Canadian General Electric Co., Ltd.

CLEVELAND *Single Spindle* AUTOMATICS

MODEL A—Built in 9/16-inch to 8-inch capacities inclusive

MODEL AA—Built in 1 1/16-inch and 1 3/8-inch capacities only

MODEL B—Built in 9/16-inch to 2½-inch capacities inclusive

GAUGES *GAUGING* GAGES

WE are making gages–checking gages–out here at VARD. It's interesting too, how circumstances put us into the gage making business.

As you know, VARD has been turning out some of the finest aircraft hydraulics, navigation plotters, and instruments produced in the United States. We had been buying precision inspection gages to check our work. But suddenly at the outset of the defense program, we found that inspection gages were very difficult to secure, especially on the Pacific Coast.

That left us in a fine fix–along with many other manufacturers here.

Fortunately, we had some of the expensive and accurate equipment required by gage makers, such as, constant temperature rooms, the super-micrometer and comparator, shown above. The comparator, for instance, can enlarge the image of a screw thread 100 times and has means for checking its pitch. With this equipment we could produce gages.

So, we did make our own gages.

It wasn't long before the industry found out that we were making gages, and the next thing we knew we were in the business.

At present we are in full production on threaded plug gages, pipe thread ring gages, or step gages, and are commencing manufacture of roll thread snap gages.

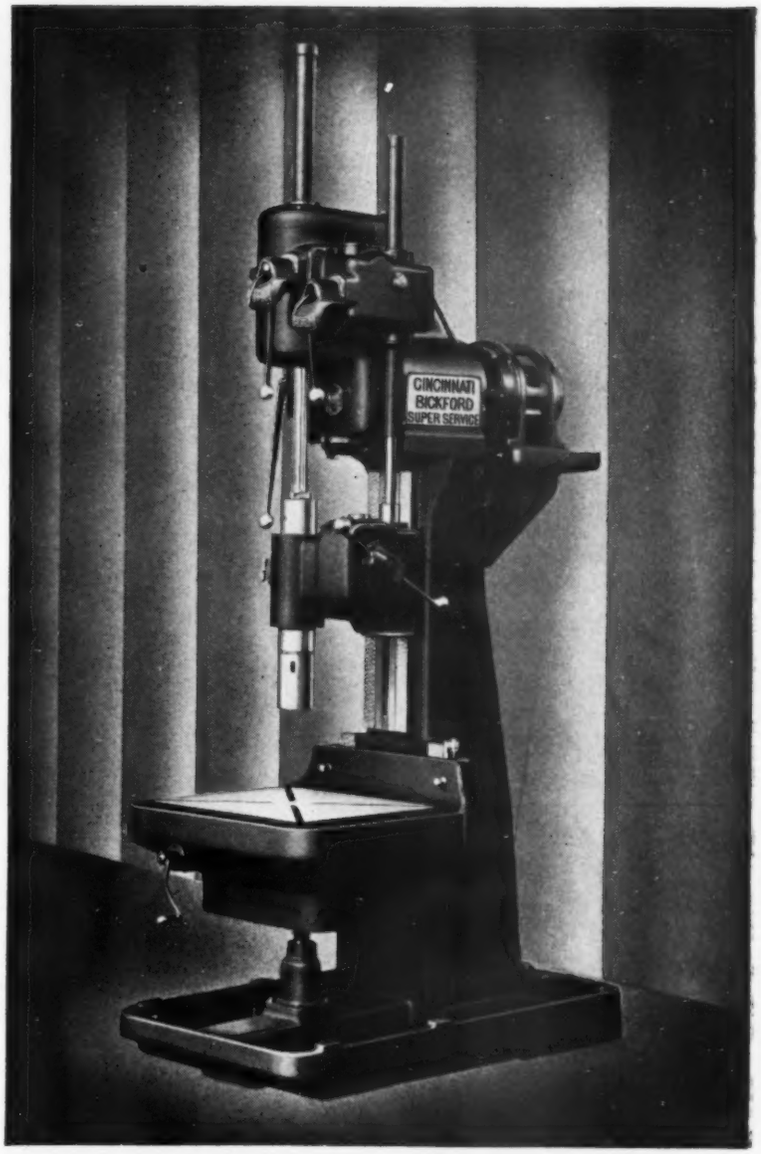
If your company is interested in any of our present products or potential developments, by all means get in touch with VARD.

The VARD trademark on a product symbolizes thorough engineering, the best in materials, and technical, precision workmanship.

VARD INC. PASADENA, CALIFORNIA, U. S. A. • SUCCESSOR TO VARD MECHANICAL LABORATORY

The Super Service
BOX COLUMN UPRIGHT

Specialized experience since 1874 has produced the Cincinnati Bickford Super Service Upright Drilling Machine. Built in 21", 24" and 28" sizes, its adaptability, reliability, accuracy, and convenience add up to sound drilling practice.



Every really usable feature that modern engineering can produce is incorporated—direct connected reversing motor drive, positive feed clutch, simplified and convenient lever controls, automatic lubrication, ball and roller bearings throughout, wide ranges of useful speeds and feeds. Summed up, these construction and plus-production features mean easier, faster drilling performance "per dollar invested."

SUPER SERVICE

Write for detailed information about our complete line of Super Service Upright or Radial metal drilling machines.

The
CINCINNATI BICKFORD
Tool Company
OAKLEY · CINCINNATI · OHIO · U. S. A.

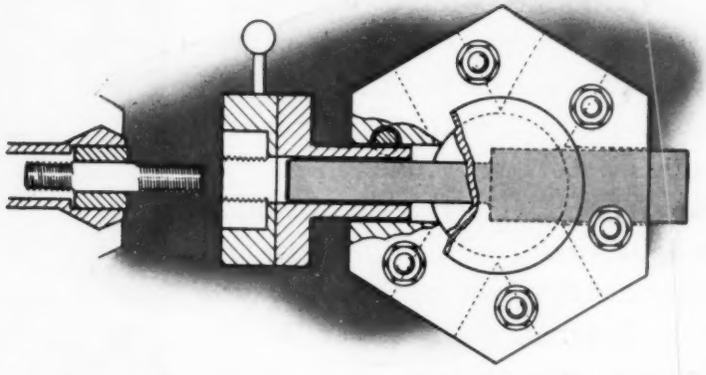
A Citation for MEN in WAR INDUSTRY

IDEAS FOR VICTORY
N·A·SNYDER

Ideas for VICTORY

..from the Production Lines behind the Firing Lines...

He Saved Time Threading Studs



This "Idea for Victory" suggested by Norman Snyder, turret lathe operator in the plant of Vaughn Machinery Company, Akron, may not be altogether new to many machinists but it's a good one, worth passing along.

Operator Snyder makes a stock stop and sets it in a hex turret station. It can be adjusted to any length thread desired. Then little attention need be paid to endwise location of work piece in the chuck. Die head and hex turret feed forward until trip opens and chasers release. No time lost for indexing and back-indexing to position the next stud in the collet.

Hundreds of resourceful operators are sending their "Ideas for Victory" to Warner & Swasey to be published in "Blue Chips," a newsy shop bulletin sent free to turret lathe operators' homes. Make sure your operators—old timers and learners—are on the list to get "Blue Chips." They'll enjoy it and profit through reading it. Write

WARNER & SWASEY
Turret Lathes
Cleveland

YOU CAN TURN IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

WHAT'S IN THIS ISSUE

W. W. McCULLOUGH

LESS MOTOR WEAR

When motors are likely to be operated at loads above normal, as so many are today, the maintenance department must be constantly on the alert for signs of trouble if maximum life is to be obtained. W. W. McCullough, Westinghouse Service Department, offers some practical suggestions on how to "Watch That Motor!" Page 431.

WHEN BOMBERS COME

It is too late to plan a system of plant protection when the bombers come winging into view. Don't think that, if they do come, you can expect much help from regular fire, police and medical facilities. These agencies will do what they can but their forces may all be tied up somewhere else when your call comes. Start now to make plans for protecting your plant, but don't start haphazardly. The basic steps recommended by Army, Navy, and Civilian Defense officials are described in an article discussing this important subject. Page 429.

PLASTICS MACHINED

Laminated plastics are light in weight and are used occasionally instead of aluminum or magnesium alloys. Although they can be machined with tools and equipment employed for working metals, they present special problems because best results are obtained with high cutting speeds and light cuts. Herbert Chase discusses these problems, using as examples specific products made by the Synthane Corporation. These examples include parts made on automatic screw machines and punch presses. Page 434.

A DUMMY FOR CAMS

Production milling of cams requires the use of a dummy templet so that the milling cutter, guided by a roller on the templet, can reproduce the cam shape quickly from blank stock. This procedure, explained by H. A. Frommelt, director of industrial research, Kearney & Trecker Corporation, incorporates the use of barrel and radial cam templets, as well as the cam slide. Page 440.

DRESSING COMPOUND ANGLES

Among the ideas contributed by practical men is a method for dressing grinding wheels with compound angles and radii. Norman Ingalls describes a method in which the radius dresser is placed on a magna-sine set at the required clearance angle. The result is a cutting tool which can be resharpened repeatedly without affecting the cutting radius. Page 444.

JOHN G. JERGENS

ARBOR DESIGN

Various types of expanding arbors intended for lathe work are the subject of another series of sketches by John G. Jergens. These practical designs have proved of widespread interest in the past, both for use in training and as practical suggestions to the men in the shop. Page 438.

SCREW MACHINES RETOOLED

A Canadian plant, engaged during peacetime as a producer of many automotive parts, found that its screw machines could be retooled readily for the production of shell percussion fuzes. In the Armament Section will be found data and drawings showing how these machines were converted for making such fuzes for 40-mm. high explosive shell. And that's not all. Special tools, jigs and fixtures had to be installed for finishing the parts made on the screw machines. These are also described. The workers, 90 percent of whom are women, were trained in a short time to familiarize themselves with the operations of these tools. Page 447.

L. P. JACKSON

EXIT TAPER

In honing blind holes the lower end of the hole doesn't receive as much cutting action as the upper area. The result of this process with conventional stones is a taper in the work. L. P. Jackson, Director of Engineering, Mid-West Abrasive Company, tells of a development which eliminates this taper by the use of a specially shaped stone. Page 443.

COMING

One trouble with training men without previous experience for assembly-line operations is the difficulty most of them have in reading blueprints. A special technique developed in the aircraft industry for meeting this problem involves the application of the familiar three-dimensional, or isometric, drawing. The use of these simple drawings instead of blueprints to convey instructions to assembly-line workers will be described in an early issue.

Bolts and nuts are usually thought of as more or less simple products, but their production is highly developed. Aircraft bolts, nuts, and screws particularly require precision operations followed by rigid inspection. The methods of inspection used for such work will be covered shortly.

SHIPBUILDING

U. S. Navy and private shipyards are bending, punching, and shearing plate on Cincinnati Press Brakes and Cincinnati Shears. Cincinnati Shapers are working aboard ships as well as in the yards.

Write for Recommendations

THE CINCINNATI SHAPER CO.

SHAPERS · SHEARS · BRAKES

CINCINNATI, OHIO.

Plant Protection

WHAT PREPARATIONS HAVE you taken to protect your plant during air raids? None?

You had better get started now! Before long you will have to do something under mandatory orders issued by soon-to-be-established Plant Inspection Divisions of the Office of Civilian Defense. The divisions which will be set up in districts corresponding to those of the OCD will be composed of one representative each from the Army, the Navy and the OCD. They will have power to order plants producing for the Army and Navy to take suitable precautions or preparations. They will bring pressure on all other plants to take similar action.

You should take certain steps without waiting to be forced. It is for your own safety and in your own self-interest that you do so. Being prepared for air raids will be insurance that loss of employees lives, damage to equipment and shutdown time will be reduced to a minimum if bombs should hit your plant. Don't be misled into believing that local civilian defense organizations will provide fire, police and medical facilities in bombing emergencies. They will do as much as they can; but their aid naturally will be limited, their forces will be overtaxed in every way, and your call for help may very likely come at a time when all equipment and manpower are tied up elsewhere. Furthermore, knowing your own plant, you are better qualified than outsiders to plan efficient protection. Don't be afraid of costs! They generally won't be high.

What should you do? First, build up a protective organization from plant personnel. Second, provide for blackout. Third, provide protection against flying window glass.

Of the three steps, the plant protective organization is the most important. It can be broken down into four divisions: fire, police, medical and maintenance services. (In small plants, the organization can be even simpler than the one described here.) At the head of the group there should be a coordinator or chief. He will direct the activities of the four divisions, maintain contact with the civilian air raid warning system and with local government authorities and control inside communication facilities. In emergencies he will control the disposition of the four services.

Each division should consist of squads dispersed so that all sections of the plant will have each service available if and when needed. Naturally, employees should be assigned to the protective service for which they are most fitted. They should be trained

first as individuals and then as squads. From that point on, the whole organization should train and practice collectively to develop the team work and coordination that mean efficiency in emergencies.

The importance of the fire-fighting service cannot be underestimated. Fires have caused 80 percent of air raid damage in England. Obviously, your plant fire chief should have charge of developing the staff and assembling the equipment to cope with bomb-started blazes. Since the enemy most likely will use incendiary bombs, the fire brigade must especially know how to handle incendiary bombs.

Let's break down what is considered an adequate fire organization. It consists of a main observation post with auxiliary units so that the entire plant area can be covered; fire watcher posts covering high-risk buildings and those vital to production; water supply; fire squads to deal with incendiary and high-explosive bombs and fires, and rescue parties trained to rescue people from damaged buildings and plant areas. The fire-fighting force should be tied up by a direct communication system so that fire reports may be filed and aid sent from one section to another when necessary.

The police service, under the plant police chief, will have charge of all police activities, the work of the air raid wardens and aircraft observers, maintenance of discipline and morale, and the handling of unexploded missiles. Guards and watchmen are responsible for all persons entering the plant area, and under the police chief they control traffic and maintain routes so that rescue trucks and outside medical and fire-fighting facilities can reach the emergency scene.

Air raid wardens act as advisers and guides to other employees, report where bombs fall and fires break out. Aircraft observers are located on the top of a building so that they can view as much as possible of the surrounding area. They report the approach of planes, dropping of bombs, fires or any other unusual activity to the senior air raid warden. During blackouts wardens make certain that all lights are extinguished, except those permitted to remain lighted for safety or other reasons.

The plant medical unit is under the plant medical chief who should be the plant physician or a practicing physician. His responsibility is the organization of first-aid service. So far as possible, all employees should get this training, with first aid squads getting intensive instruction. Stations in charge of trained workers should be located in all sections of the plant. They should be equipped to render whatever treatment is necessary until the injured persons can be removed to a hospital.

The final and not the least service is that of maintenance. This service is headed by the chief engineer, assisted by technicians to deal with plant utilities; electricity, steam, gas and water. During air raids men are stationed in pairs at all controls. They close mains and turn off switches when bombs strike. Other skilled men, such as machinists, welders, plumbers are organized into repair crews.

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"It is a matter of common sense that in every industrial area we prepare as quickly and as thoroughly as possible complete air raid protection for all plants, for we know not when, where or how hard the enemy will strike. The question of defense against air raids, is one of the important problems at hand.

"Some will scoff at the idea that an air raid can be made on this particular industrial area. Don't be misled by erroneous information, for the answer definitely is *yes it can!* Moreover, it is a part of Hitler's technique to do the so-called impossible."

From an address by Rear Admiral Clark H. Woodward, U. S. Navy (Ret.), Head of Plant Protection Division, Office of Civilian Defense.

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Immediately following an air attack the chief engineer surveys the plant and makes decisions regarding repair of damaged walls, removal of debris, and restoring plant-working conditions to normal. All clearance and repair work must be speeded so that manufacturing operations can be resumed with a minimum of delay.

It has been recommended that all key valves for steam, gas and water, and all switches be clearly marked with instructions as to how they should be regulated during an air raid. This will make it possible for any workman to take the necessary steps, should the men stationed at this post be knocked out by a bomb hit.

Blackout means the obscuration of light so that it cannot be viewed from the air, either directly or indirectly. Many factories can do this simply by turning out all lights. Other factories, however, working on strategic war materials, have to keep in continuous operation. For them blackout is more difficult, involving the screening of light so that it cannot be seen outside. Opaque shutters must be built over windows and light locks provided at entrances.

Most outside lights can be extinguished, but those that must be kept on should be covered with orange shades. So that essential communication can be maintained, white guard lines are painted on walks and drives. All these blackout provisions can be defeated by any large building or object which reflects light. Therefore, these surfaces should be repainted to produce a rough non-reflecting surface.

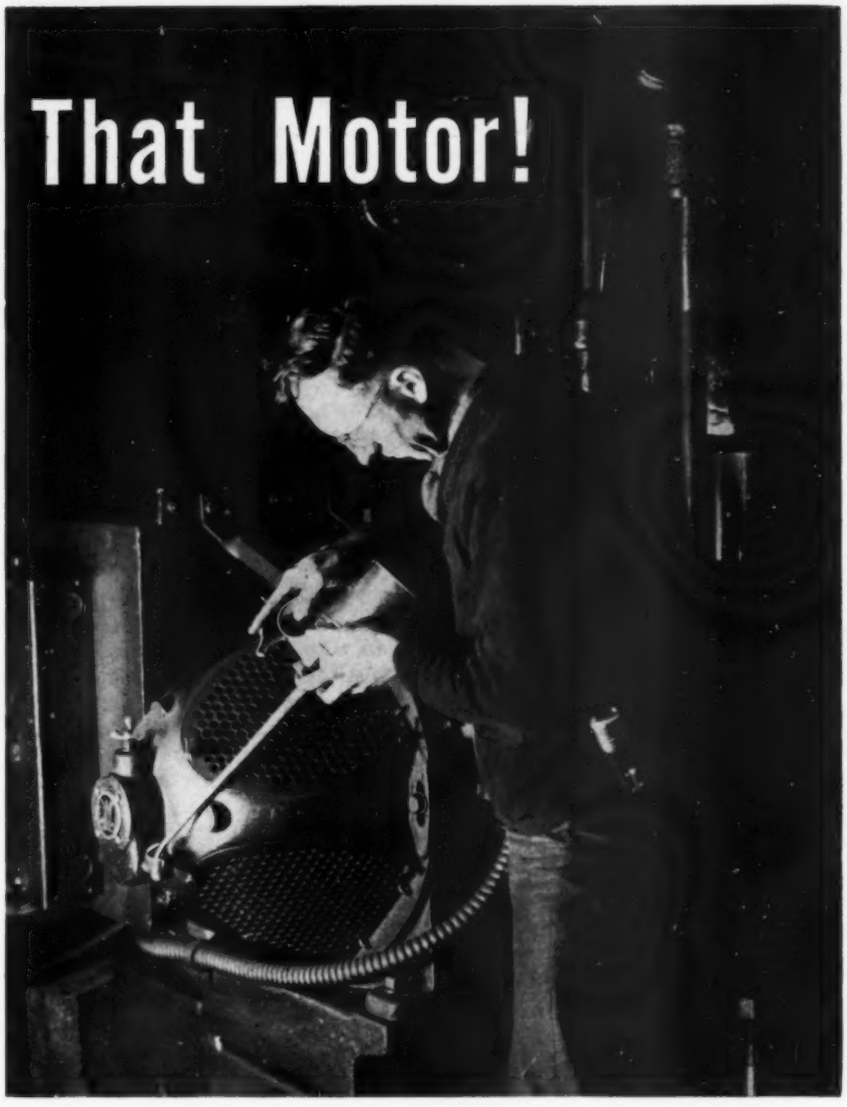
Flying glass, caused by bomb hits or near hits, not only cause much damage physically, but have a detrimental effect on morale. English workers refuse to enter plants where proper precautions have not been taken to minimize this action. The best protection is to brick up windows on the outside with walls 12 in. thick and interlocked with existing walls. However, it is obvious at present that this is not a very practical procedure. Steel and wood shutters and heavy cloth or quilted curtains may also be used on the inside, and have the advantage that they can be removed, except during an actual raid. These, of course, are less effective, but do limit the effect of the blast. Often shutters can furnish both blackout and glass protection.

These are the steps which Army and Navy and Civilian Defense officials want you to take. Detailed descriptions of recommended procedure for setting up the protective organization, for providing blackout and for preventing flying glass are included in pamphlets prepared by the Office of Civilian Defense. The compilation and writing of material was supervised by the Chief of Engineers, U. S. Army, and the Engineers Corps has tested and approves the recommended practices. Local OCD office will be glad to procure whatever literature you need.

Further assistance and advice in doing the right things will be given by the Plant Protection Division of OCD. Members of the Division, mostly Engineer Corps officers, are located in each district OCD headquarters. In addition the division is holding Plant Protection Schools in every state. For plants working on War Department contracts, the Office of the Undersecretary of War has published a small textbook, entitled "Plant Protection for Manufacturers." This volume is restricted but if you have a War Department contract you can get a copy.

Watch That Motor!

In times like these, when all production equipment must be kept running most of the time, preventive maintenance saves breakdowns. Try these hints



Periodic lubrication and frequent preventive maintenance go a long way toward insuring the proper functioning of motors

BY W. W. McCULLOUGH, WESTINGHOUSE SERVICE DEPARTMENT

MAINTENANCE of a.c. motors for machine-tool drives and similar applications in metal-working plants is a difficult job to handle under present emergency conditions. Generally, machine tools these days are overloaded. This increased burden on stator coils and rotor windings, and on bearings, calls for constant vigilance on the part of maintenance forces. From a maintenance standpoint any motor which is operated at loads above normal should have regular attention given to the rotor windings at scheduled inspection periods.

The a.c. squirrel-cage induction motor is one of the most rugged pieces of rotating electrical apparatus built. The speed at which it runs depends upon the load. Running light, or at no load, the rotor practically approaches synchronous speed. As load is applied, the speed drops below synchronous speed. This drop in speed is known as the slip. While the slip depends on the load, it also is a function of the design of the motor. The greater the secondary resistance, the higher is the starting torque. To offset this desirable feature, the slip increases with consequent increased losses and lowered efficiency.

Voltage conditions are likely to be under normal in periods of emergency with increased duty and heating in both stator and rotor winding. Some plants have to contend with variations in frequency as well as voltage, although this is not true in plants fed from large central stations. The accompanying table shows the effect of voltage and frequency variations on power factor, torque, and slip.

Punch press motors have high-resistance rotor windings and are designed especially for the application. If the machine is called on for an excess duty cycle, the motor may suffer from excessive heating of the rotor winding.

More trouble can be expected under abnormal conditions from single-phase operation. Where machine tools operate for long periods without stopping the driving motor, single-phase operation can cause serious heating of the stator windings before the condition is discovered. This calls for careful inspection of fuses and relays as well as starters and switches. Customary protection through fuses and relays falls far short of the ideal. To get the maximum safe output from a motor, a thermostat built into the windings is the answer. If the motor was not originally provided with this protection, it usually can be added.

Bearings and lubrication are of the greatest importance regardless of the size of the apparatus or of the type of bearing used. For example, an analysis of induction-motor failures shows the bearings to be the principal offenders. This is important because failure of a sleeve bearing allows the rotor to rub against the motor stator.

Sleeve bearing design in general is based on the fluid theory of lubrication. The oil, because of its adhesion to the shaft and its resistance to flow (viscosity) is, by the rotation of the shaft, dragged along so as to form a wedge-shaped film between shaft and bearings. This film completely separates the bearing surfaces so that there is no metal-to-metal contact. *There is, therefore, no bearing wear when running.* Without this film no great load can be borne by the bearing except with high friction. Formation of the film causes a slight lift of the shaft. Its thickness has been carefully measured. The range is from a little under 0.001 in. to a little over 0.003 in.

Most sleeve bearings have ample overload capacity, provided they are properly maintained and fed with the

proper grade of lubricating oil. "Properly maintained" covers a lot of territory. Inspection schedules made up after a careful study of the conditions should be rigidly followed. Newer types of sealed-sleeve bearings require little attention, since the oil does not become contaminated and oil leakage is negligible. Maintenance of the correct oil level is frequently the only upkeep required for years of service. Older types of sleeve bearings require more frequent inspection and checking for wear, and frequent oil changes.

What Makes a Hot Bearing

Safe temperature rise for a sleeve bearing is considered to be 40 C. above room temperature. At this reading a bearing feels only comfortably warm to the bare hand. A hot bearing is probably due to one of the following causes: (1) no oil, (2) excessive belt tension, (3) failure of the oil rings to turn with the shaft, (4) rough bearing surface, (5) improper fitting of the bearing, (6) bent shaft, (7) a poor grade of oil, or dirty oil, (8) end thrust due to incorrect leveling, (9) end thrust from magnetic pull, or (10) excessive side pull because the rotating part is out of center.

Every maintenance man has had to contend, at one time or another, with old, oil-soaked motors. When emergency conditions compel the use of these veterans, something has to be done to cure the trouble. Oil rings carry a considerable amount of oil; far more than is necessary for proper lubrication. When running, most of this oil is carried on the outside diameter of the rings by centrifugal force.

It would probably be safe to say that most leakages are caused by air currents passing through the openings in the bearing housing, the result of blower action by the moving parts of the apparatus. It is, therefore, essential to avoid such openings where the outside suction is high. Here is where the felt washer does good work.

The purpose of the felt washer is to seal the housing against air currents. Only as an air seal will the felt washer be of any real benefit. Even then certain points will have to be observed:

1. Use the highest obtainable grade of soft felt.
2. Use a felt washer not less than $\frac{1}{4}$ in. thick before compression.
3. Make a good mechanical job of cutting the washer so that inside diameter of the washer is true with edges at right angles to the surface of the felt. Make the inside diameter the same as the shaft, or a trifle under.
4. Make the sheet steel supporting washer with an inside bore larger than the shaft diameter by about twice the thickness of the felt. This permits the felt to expand next to the shaft and retain its resilience.

For all ordinary conditions, the felt washer has probably come nearest to solving the problem of oil leakage, provided the suction is not very high. In cases, however, where the suction is high enough to create a vacuum at the housing face of $\frac{1}{4}$ in. of water or over, then other measures must be applied.

For these high vacuum conditions, it will probably be necessary to use some sort of an air bypass such as is incorporated in most modern sleeve bearings. For old bearings, this often means considerable work.

Oil leakage is generally aggravated by high temperatures. See that bearings operate cool and use an oil which does not foam easily.

In a ball bearing, a series of balls acts as the separating medium between the stationary part and the moving shaft regardless of whether in operation or at rest. The starting friction in ball bearings is practically the same as the running friction. Lubrication is required because while the balls roll in the races, they make sliding contact with the surfaces of the retainer.

Vertical motors usually have oil-lubricated ball bearings for taking the thrust load. Their housings are provided with oiling and overflow fittings and the same instructions for filling, and maintenance apply as are given above for sleeve bearings.

Horizontal ball or roller bearing motors in general are grease lubricated and are shipped with sufficient grease in the bearings to last for a limited period. It is well to add a sufficient quantity of good neutral grease to fill the housings half full. Avoid filling housing too full; it will cause overheating of bearings. Remove all grease, thoroughly clean bearings and replace with fresh grease about once a year, disassembling housings to give access to bearings. Avoid admitting dirt into ball or roller bearing housings, as a small quantity of dirt will rapidly destroy the bearing.

The temperature rise to be expected when using ball bearings varies considerably, depending on a great many factors such as size of bearing, speed at which it is run, whether one or two rows of balls or rollers are used, kind and quantity of lubricant used, etc. The permissible total temperature of a large, high-speed ball or roller bearing may be as high as 100 C., but such a temperature on an average open motor would be indicative of serious trouble. Bearings of the average open motor will usually show a temperature rise of from 15 to 30 C.

Excessive wear or overheating of ball bearings may be traced to one of the following causes: (1) excessive belt tension; (2) no lubrication or too much lubricant, causing churning, or gummy residue from old grease, (3) poor alignment, causing excessive vibration or binding, (4) dirt in the shafting, (5) bent shaft, or (6) excessive end or side thrust due to faulty couplings.

If the bearing begins to exceed its normal temperature rise, slacken the belt or reduce the load, if possible. Should the bearing remain hot, it will be necessary to shut down the motor to determine and remove the cause of the trouble. Worn bearings may be detected by checking the air gap. They should be replaced before there is danger of rubbing.

Replacement of a bearing calls for precision work. When removing the old bearing, avoid pulling off by means of the outer race. The pulling tool should be applied at the back of the inner race.

The replacement bearing should preferably be heated before being placed in position on the shaft. The old method of heating in a bath of hot oil has been replaced by heating in an electric oven. Roaster ovens are successfully used for this purpose, the bearing being left in its original wrapping to safeguard against dirt and grit. The use of a roaster oven reduces the heating time, and the inconvenience of properly maintaining an oil bath is eliminated. The paper container is removed as the last operation before the bearing is slipped into position.

If neither electric heat nor an oil bath is available, the replacing bearing should be bumped on, driving invariably through the inner race by means of a tube or other spacer of soft material such as copper, lead, or hardwood. Never hammer directly on the race. Keep the bearings clean.

Use Oil in Gear Motors

Increased use of gear motors calls for proper attention to correct lubrication. There are two points to keep in mind; the gears themselves, and the bearings. The motor bearings, usually ball, will probably be grease lubricated and have already been discussed. The exacting requirements of the gear units and of their bearings demand high grade oil for lubrication.

Areas of contact on gear teeth are

EFFECTS OF VOLTAGE AND FREQUENCY VARIATIONS ON SQUIRREL-CAGE MOTORS

Variations	Power Factor	Torque	Slip
Voltage high	Decreased	Increased	Decreased
Voltage low	Increased	Decreased	Increased
Frequency high	Increased	Decreased	Same
Frequency low	Decreased	Increased	Same

relatively small and the pressures produced in transmitting the loads are relatively large. It is, therefore, essential to provide a film of lubricant of sufficient strength to withstand the localized pressure during the period of contact. The peripheral speed of the gears governs the period of tooth contact and determines the time during which the film must withstand the pressures. When speeds are high, the time is very short, the loads are usually light, and a comparatively light bodied lubricating oil can be used. When speeds are low and the loads heavy, the contact time is considerably longer and a heavier bodied oil should be used.

Viewed from the maintenance angle, induction motors having wound rotors differ from the squirrel cage type mainly in the addition of the collector and brush rigging.

Collector rings and brushes always collect some dust. If this dust is allowed to accumulate, it may cause breakdown in the insulation of various parts of the machine. It will also cause sticking of the brushes in the holders. For this reason the brushholder and collector parts should be kept thoroughly cleaned.

Sparking, when it occurs in regular operation, is in general caused by imperfect contact between brush and slip ring. This may be caused by: (1) introduction of dirt or particles broken from the edge of the brush between the brush and the ring; (2) lack of free movement of the brush in the holder either because of too tight fit, or cramping due to a too loose fit—brushes may stick in the holders because of the collection of dust between the brush and holder; (3) sluggish springs which fail to keep the brush in contact with the ring when there is any vibration; (4) rough or untrue collector rings which cause momentary separation between the brush and ring; (5) vibration of collector rings, brushes or brush supports which also cause momentary separation; (6) incorrect alignment between brushes and rings which results in a thin edge of the brush overhanging the ring which chips and breaks off; or (7) excessive current density due to overloads. The mechanical contact is never perfect and high current density will cause sparking with brush fits which would be accurate enough for normal densities.

When sufficient graphite is present for good lubrication, the brushes on the ring which has the highest polish may be considered to be giving the best service. In general, blackening and cutting of the ring is an indication of bad brush service.

To stop sparking, first get good contact between brush and ring. Guard against occurrence of the causes of sparking enumerated above. It often happens that some one brush is carrying more than its share of the current. Relieve the pressure on this brush temporarily and adjust pressures so that each brush will carry its share of current. In doing this, avoid excessive pressure which causes wear.

Synchronous motors are not widely used in metal-working plants. The stator windings are similar to those used in induction motors and the mechanical assemblies are about the same. The collector problem is very like that for a wound rotor induction motor.

In coupled machines, one pedestal is sometimes insulated from the bedplate to prevent shaft currents which, under certain conditions, will flow through the circuit composed of the shaft, bearings, pedestals and bedplate. This current may be sufficiently large to pit the shaft journals. It is important, therefore, to see that there is no metallic connection between an insulated pedestal and the bedplate.

Watch Field Current Value

Ordinarily the motor field current should be adjusted for full load conditions as given on the motor nameplate and set for all loads, as this maintains the pull-out torque of the motor and gives better power factors for lower loads. An increase in field current will increase the pull-out torque. Thus, in an emergency, a synchronous motor can be made to hold in step at a considerable overload by over-exciting the field. The length of time that this can be continued is limited.

The field coils introduce a new factor to be considered in the maintenance program. A lot of dirt collects on the fast moving pole pieces and coils. Keep this blown off at the regular inspection shutdowns. Pay particular attention to the field coil washers so that the creepage distance will be maintained.

Operating instructions provided by the manufacturers emphasize the importance of keeping electrical apparatus clean and dry. Favorable locations, suitable enclosures and adequate ventilation, drip-proof covers, splash-proof protection, and heaters to prevent condensation when apparatus is out of service, all reduce interruptions and lower maintenance costs. However, when electrical apparatus does get dirty, insulation must be cleaned.

When the apparatus is small and only dry dirt has collected on exposed parts, cleaning with a dry cloth may be satisfactory. Waste should not be used as the lint will adhere to the insulation and collect dust, moisture and oil.

Clean Motors Carefully

Blowing out dirt with air (50-lb. per sq.in. maximum pressure) is usually effective, particularly when the dirt has collected in places which cannot be reached with a cloth. Generally, cleaning can be done more quickly with compressed air than with a cloth. This applies especially to large apparatus. Do not direct compressed air against insulation until certain that it is free from moisture that may have accumulated in the air line from condensation. Too great an air pressure may loosen binding tape and blow dirt under it. Dirt blown out of a machine is likely to be drawn into others that are in operation near it. Remember, the use of compressed air simply transfers the dirt from one location to others and unless the final location is outside the operating room, very little good may be accomplished.

If the accumulation of dirt contains oil or grease, a solvent will usually be required to remove it. There are three types of solvents in general use for this purpose. These are petroleum distillates, such as benzine or gasoline, carbon tetrachloride, and a mixture of the two.

Solvents known commercially as "Stoddard Solvent" (described in U. S. Bureau of Standards as "Commercial Standard CS-3-28"), cleaner's naphtha, or safety solvents minimize the fire hazard and should be used in preference to gasoline or benzine, but ample precautions should nevertheless be used to prevent fires or explosion.

When this type of solvent will not properly clean the apparatus, a mixture of carbon tetrachloride and petroleum solvents may be used. A mixture of 50 percent carbon tetrachloride and 50 percent benzine is noninflammable but the vapors mixed with the right proportions of air are explosive.

Machining Laminated Plastics

By HERBERT CHASE

Much of the rod and tubing used in making screw-machine products from laminated plastics is ground before being cut on the screw machines

High speeds and light cuts are recommended for this material. Parts can be machined, punched or blanked with standard tools

LAMINATED PLASTICS are available today in sheets, rods, tubes and special shapes, more or less paralleling the forms in which wrought metals are produced. So it is not surprising that they can be finished readily with the tools and machines employed for working metals.

Laminated plastics weigh considerably less than magnesium alloys and about half as much as aluminum, and occasionally are used in place of these and other metals. In general, however, they are chosen because of certain characteristics not found in metals, including good dielectric properties, freedom from corrosion, general inertness to chemical attack, light weight, adaptability for use in quiet and long-lived gears and bearings, good abrasion resistance, and high toughness and strength.

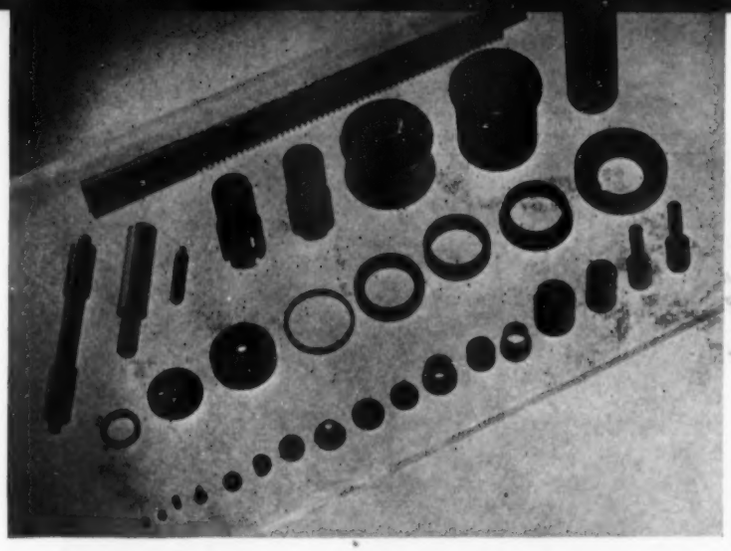
Nearly all the commoner forms of machine tools can be used for machining laminated plastics. However, high-speed units are most commonly employed since machining of such plastics is expedited and best results are secured when cuts are light and speeds are high. The illustrations show the types of screw machine and other products made at the Synthane Corporation's plant at Oaks, Pa., where the particulars here set forth were secured.

Several screw machines are in continuous use and they turn out products ranging in size from that of a pin head up to about 2 in. in diameter. Some are equipped with transfer attachments used for such operations as burring, slotting and cross drilling, and some have magazines for automatically feeding short rods or tubes. For some small parts, speeds as high as 6,000 r.p.m. are used effectively.

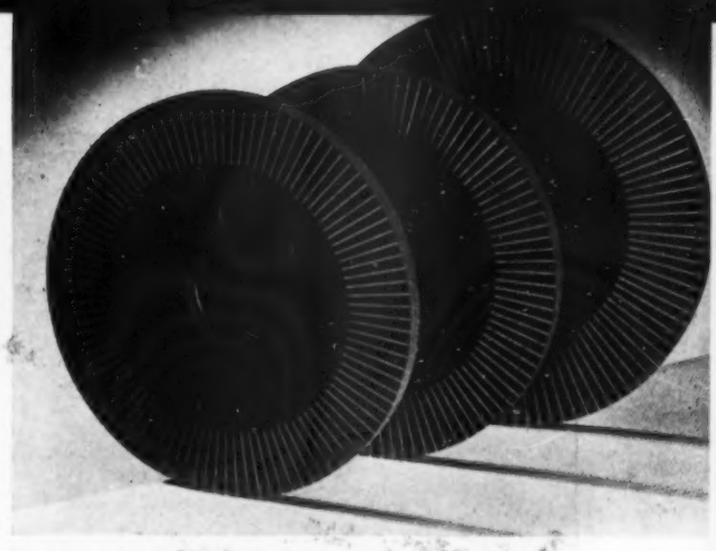
Typical of the medium size parts produced is a bushing having a narrow flange at one end and made from $\frac{7}{16}$-in. rod turning at 3,600 r.p.m. The flange is turned to 0.410 in. outside diameter and the barrel, using a box tool, to $\frac{3}{8}$ in. diameter. End operations include spotting and drilling a hole the length of the piece and 0.258 in. in diameter. A forming tool chamfers corners of the flange and a common tool is used for cut off. The production rate is 7 sec. per piece. A cylindrical bushing $\frac{5}{16}$ in. diameter with a $\frac{3}{16}$-in. hole 0.437 in. deep is produced from bar stock in 5 sec. In this, as in most drilling where the hole is deep, a coolant made from half kerosene and half paraffin oil is used, primarily to help keep the drill cool. A piece having the shape of half a spool, with the flange beveled and $1\frac{3}{16}$ in. diameter, is produced in 22 sec., the work turning at 1,500 r.p.m.

Uncounted turning operations are done on tube and bar stock. Some are performed on sheet when circular blanks are required. Most of the lathes used are light bench types, especially for small parts involving light cuts. Large work is done on heavier lathes designed for high speed. Among the parts turned in large quantities are cages for ball bearings. These are produced from laminated tubing originally made from fabric impregnated with Bakelite varnish; this is rolled tightly on a mandrel and cured on the mandrel to set the resin. This process results in a light tube of homogeneous section well adapted for making cages.

In the first operation on the cages, a short length of tube is chucked in a lathe and rings of the required width are cut off with a straddle parting tool. A tube of $1\frac{3}{4}$ in. outside diameter is turned at about 1,800 r.p.m. Rings thus cut are mounted four at a time on a mandrel slightly shorter than the combined length of the rings and are clamped endwise to prevent them from turning on the mandrel by an end disk on the tailstock center. The outside diameter is turned with a car-



Here are typical parts made by the Synthane Corporation on a Brown & Sharpe screw machine. They range in size from those no larger than a pin head to ones 2 in. in diameter



Screw-machine cams for controlling the tools are made from laminated sheet disks with radial marks at 5-deg. intervals. The cam is cut on a bandsaw

bide-tipped toolbit feeding at 0.004 in. per revolution, the work turning at 1,800 r.p.m. When boring the inside diameter, rings are mounted separately in a chuck made from Synthane, the speed again being 1,800 r.p.m.

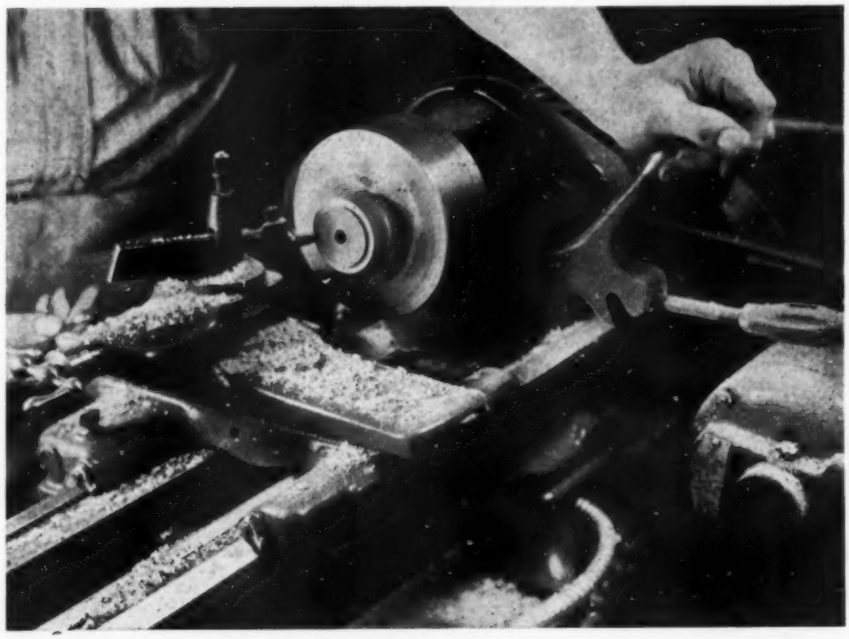
Cages of this size require many radial holes equally spaced. These are drilled on light drill presses with the work mounted on an arbor held in an indexing fixture. The fixture has a drill guide bushing fixed just above the work. In other cases, the ring is mounted inside a ring-shaped jig having a drill bushing for each hole and mounted so that the ring can be turned to bring the holes successively under the drill. The drills have "fast" helical polished flutes, points with 90 to 100-deg. included angle, and cutting edges with a 3-deg. rake. Such drills help to remove chips rapidly. Although considerable heat is developed, drilling is done without a coolant and holes can be held within 0.005 in. of specified size. On other work, where deeper holes must be drilled, it is often necessary to back the drill out occasionally to help keep it cool.

Bearing cages must be held within rather close dimensions and be free of burrs. The latter are removed around holes by small spherical Carborundum wheels of 100 to 120 grain size turning at high speed. Some bearing races are split through the central plane, in which case burrs can be removed by buffing the halves separately.

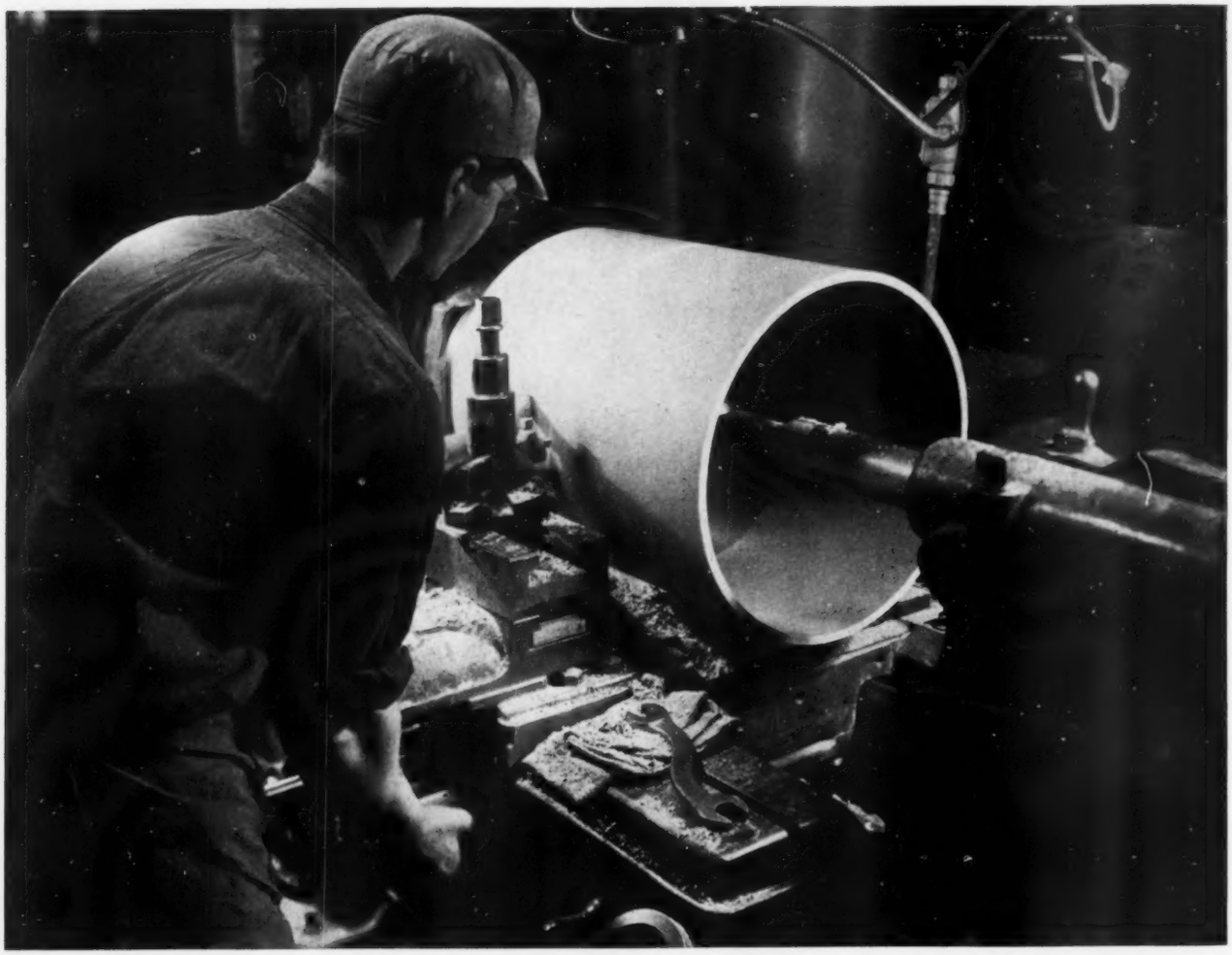
Some tubes, especially for coil forms running up to or above 8 in. diameter, require external threads having a rounded root in which a wire is later wound by the purchaser. Such threads are produced with a single-point tool having a contour the shape of the groove required and are made from Stellite. The tool is given zero rake and is placed about $\frac{1}{32}$ in. below center. As the pitch is fairly coarse and the end of the thread often comes at previously drilled holes through which the wire is later passed, the work must be turned slowly so that the lathe operator can pick up and end the thread at the required points. Some such threads have to be 0.050 in. deep and 0.050 in. wide at the crest. In such cases, three separate cuts 0.015 to 0.020 in. deep are taken.

Among the many parts produced are tubes of 8 and 12 in. diameter with a $\frac{1}{2}$-in. wall and about three times as long as the diameter. The tubes are used for chemical treatment of small metal parts and are drilled with numerous holes. Drilling is done on a Natco multiple-spindle machine so that nine or more holes can be drilled at a time. The tube is mounted on a fixture that can be shifted longitudinally and also indexed to give the required angular spacing of the radial holes. Later, one end of the tube is threaded to receive a screw cap and rings made from sheet stock, the latter of which are pressed over the outside of the tube. Such parts made of laminated plastics have high resistance to chemical attack and have had much to do with the commercial success of the electro-chemical process in which they are used.

Many milling operations, including the forming of special contours and the cutting of slots, are required on aircraft parts and other products. As quantities are often too small to warrant special milling cutters, much of the work is done with fly cutters. These have only a single cutting edge



Numerous turning operations on laminated plastics are done on light lathes using high speeds and light cuts. High-speed steel tools are often used, although carbide-tipped tools are best for long runs



Tubes as large as 12 in. diameter are readily turned and bored for radio core forms and other purposes. Some have threaded grooves cut on the outside diameter for winding wire

not too difficult to grind to the required contour. The work must be held securely, but it is often feasible to mill simultaneously several pieces clamped in a single vise on the bed of the machine. High speeds and light feeds are the rule and the tool, when cutting across laminations, must turn in such a direction that it tends to press the laminations of the material together rather than to force them apart. The toolbits are usually of high-speed steel, but carbide tips are used to advantage if a stock shape can be employed or if the quantity of parts needed is sufficient to warrant the expense.

The most rapid method of producing parts which can be made from sheet or strip stock up to about $\frac{1}{8}$ in. thick is by use of the punch press. Millions of such parts are produced annually. Work on the punch press is confined to punching and shearing operations, since laminated plastics are not suited for forming or drawing in the way that sheet metal is formed and drawn. It is possible, however, to do some forming and something equivalent to drawing of simple shallow shapes. These are formed by molding laminated stock which is not yet cured. Such work is done in hot molds in hydraulic presses and requires much time for curing, for which work the press is not suited.

Punching is commonly done with strip stock, the strips first being cut from sheets, usually by circular sawing. A typical saw for such work is 14 in. in diameter and runs at about 3,600 r.p.m. It is hollow ground about 0.012 in. on a side for clearance, and the teeth have no set. Their rake angle is about 7 deg. and they must be kept sharp to avoid chipping.

In punching, best results are secured when the material is warmed to about 180 F. Warming is done on hot plates adjacent to the press, usually wide enough for several strips so that, by loading the hot plate near one side and taking a hot strip from the other side, there is time for proper heating of each strip before it is fed through the die. Dies often have two stations, the first for punching holes and the second for shearing the piece from the strip. As the strips are never long, they are commonly fed along by hand although mechanical feeding is sometimes feasible.

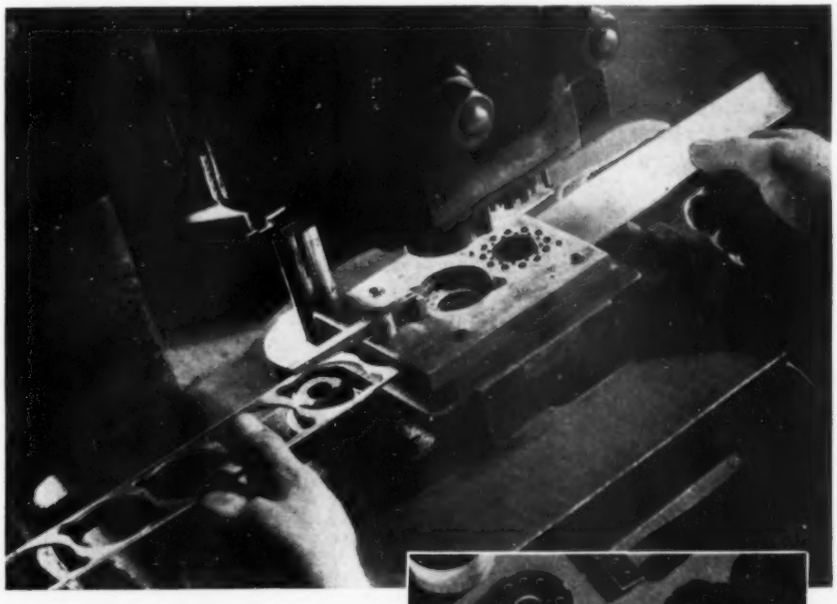
The rate of production varies greatly with the pieces being made, the thickness of the stock and other factors. For example, pieces $\frac{5}{16}$ in. wide and with two $\frac{3}{16}$-in. holes can be punched and sheared from $\frac{1}{8} \times 1$-in. strip at the rate of about 180 pieces a minute while the strip is being fed through the die. This, however, does not allow for handling the strip into the die or for delays which occur in clearing the die, starting a new strip and the like. Burrs on the sheared edges of punched parts are usually removed by sanding belts.

Parts with curved or irregular contours and which are either not required in quantities sufficient to warrant the making of a stamping die or which must be made from sheet too thick to be stamped are usually cut to shape from sheet stock on band saws. Such saws generally have four teeth per inch and are set to cut a slot about $\frac{1}{16}$ in. wider than the thickness of the saw,

which is 0.045 in. for saws 1¼ in. wide and 0.035 in. for saws 1 in. wide. Holes too large to be drilled or of irregular shape are cut with jig saws.

Pieces having open shapes, such as angles or channels, or odd contours (such as might be extruded if they were to be made from metal) are now being produced by a process which is a combination of laminating and molding. Stock used is fabric which has been impregnated with Bakelite varnish, the same as for other laminating, and from which the solvent has been evaporated. This stock is flexible and is cut into required lengths and then is laid in the mold cavities in such quantities as are needed to form the section specified. In some cases, partly cured rod is also laid in to give extra thickness at some point in the section. After heating to soften the material, the mold is closed slowly and, when shut, molds and cures the piece or pieces to the required sectional shape. When cured, the sections are removed and can be cut by sawing or by an abrasive cutter into the required lengths.

Parts of simple shape, such as gear blanks or aircraft cable sheaves, are sometimes molded partly from disks of impregnated but uncured fabric and partly from flakes of mascerated fabric of the same type. Thereafter, the molding can be machined, say by cutting gear teeth or a sheave groove on the periphery much as if the piece were a metal blank. This process avoids the waste which would result from cutting the blank from heavy sheet, yet provides a long thick hub as well as a thin flange. Parts which have to be "dished" to form a spherical surface or diaphragms like those used in radio speakers are molded from impregnated but uncured sheet stock. The depth of "draw" in making such parts is limited by the stretch which can be imparted to the fabric by the molding operation without rupturing the fabric. Products of this type are usually quite thin, being made from a single layer of treated fabric. Flash can be sheared off and holes punched after molding.



Die sets similar to those used for metal are employed for punching and shearing laminated strip stock. This plastic material is heated on hot plates before feeding into the press

Synthane products are chemically resistant and are used as containers for pickling of metal parts. Holes are drilled with the tubing mounted in this indexing fixture which is moved back and forth under the multispindle drill

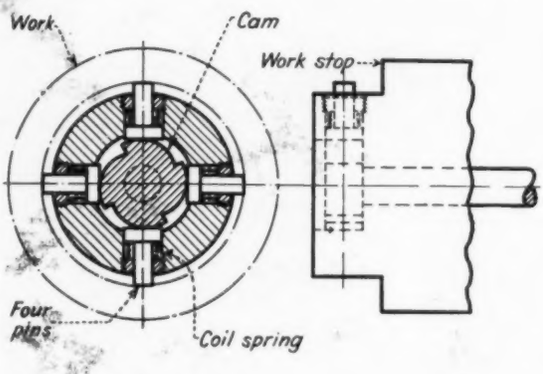
Expanding Arbors for Lathe Work

BY JOHN G. JERGENS, CLEVELAND PNEUMATIC TOOL COMPANY

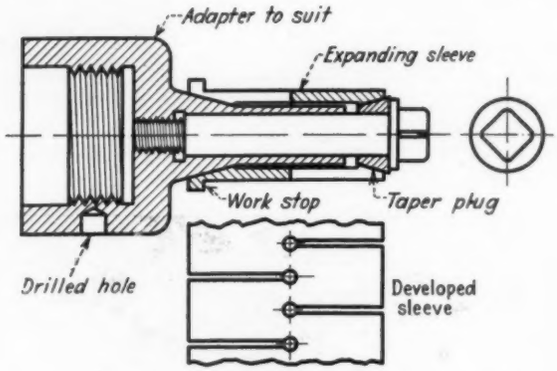
TWO GENERAL TYPES of expanding arbors for lathe work are dealt with in the drawings on these pages. In one type a tapered rod or cam is used to expand pins or keys to hold the work. Such arbors are ideal for holding rough castings or work with irregular inner surfaces.

In the other type of arbor, a sleeve or bushing into which several slots have been cut is expanded by forcing a tapered plug into the sleeve. The sleeve can be slotted in such a way and the tapered surfaces of the arbor so designed that the entire sleeve will expand uniformly, so that one end only will expand, or so that each end but not the center will expand. Such arbors are well suited for holding work having smooth, cylindrical inner surfaces. It will hold the work more firmly than the pin-type arbor, but the sleeve has a tendency to lock on the taper and some difficulty may be encountered in removing the work. This tendency to lock can be partially overcome by an arrangement which withdraws the taper from the sleeve when the chuck is loosened. Some of the designs included here employ such an arrangement.

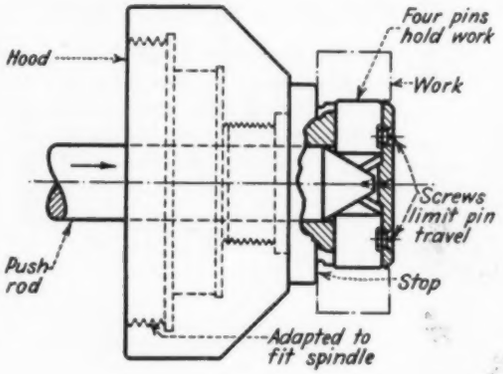
All of these arbors provide a positive locking action. The different types and the variations in design shown here indicate the ways in which an expanding arbor can be adapted to suit the needs of particular situations that are likely to be encountered in actual practice.



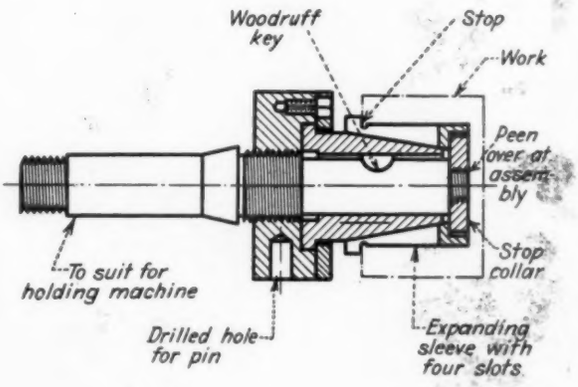
This equalizer, which is used for rough castings, has a cam operating four pins which hold the work



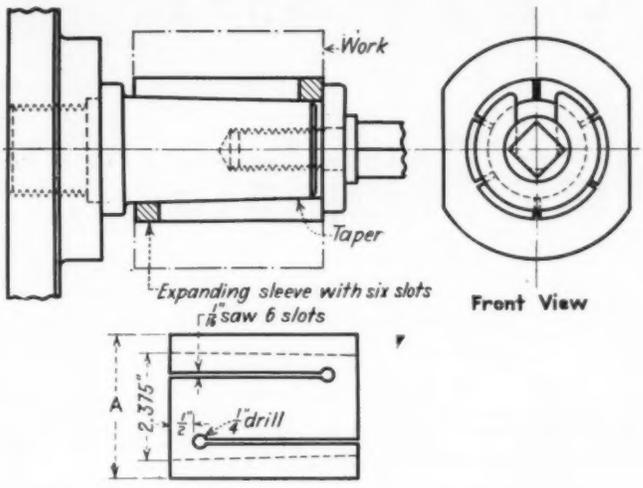
Tightening the nut against the taper plug of this arbor expands the ends of sleeve and holds the work



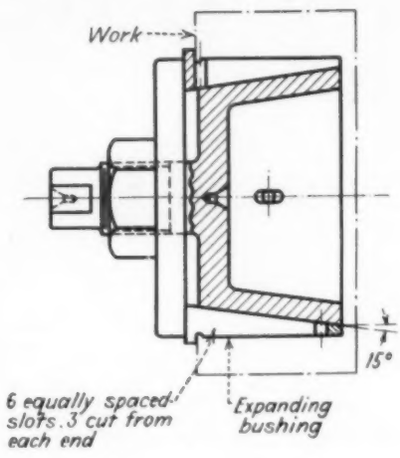
A push rod tapered at the end and operated by a hydraulic arrangement is used to expand four pins which hold the work in this compact arbor



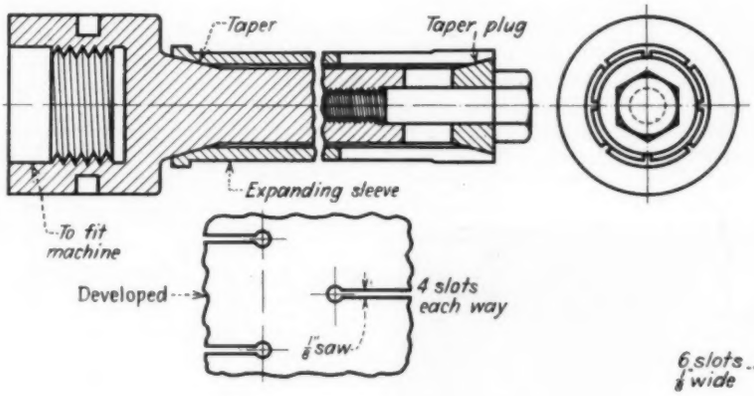
The taper movement in this expanding arbor is controlled by tightening or loosening the hood with a pin. A Woodruff key permits horizontal movement of the taper but keeps it from revolving with the hood



Tightening the nut at the end of this arbor applies pressure through a taper shank to an expanding sleeve with six slots. The entire sleeve expands to grip the work

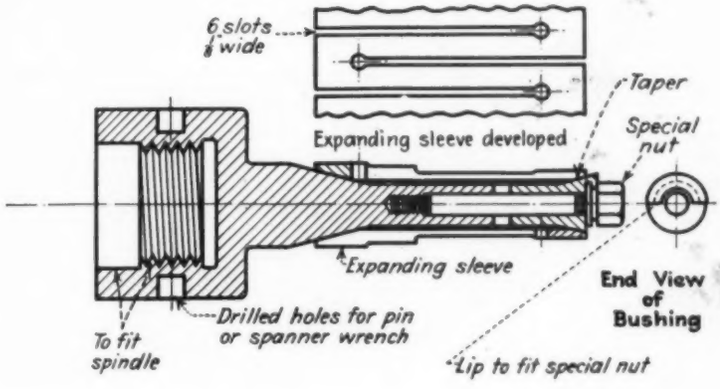


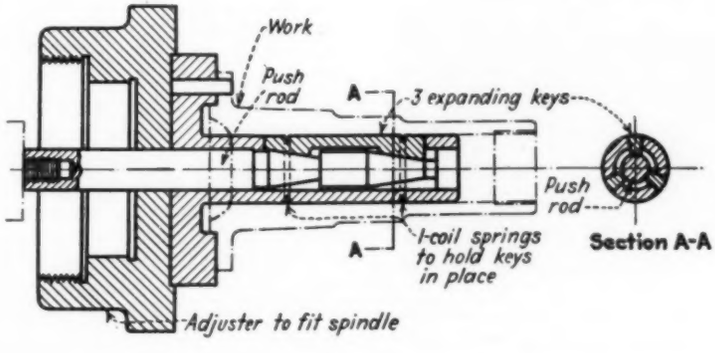
This grinding arbor uses an expanding bushing to hold the work. A pin operating in a slot in the bushing prevents turning when nut is tightened



Each end of a long piece of work can be held in this arbor. Tightening the nut causes the ends of the sleeve to expand, providing a two-point contact

The tapered bushing that fits in the end of the expanding sleeve has a lip which fits into a groove in the special nut used. This pulls the bushing out when the nut is loosened, helping to release the work





Three long expanding keys provide the holding force in this arbor. A push rod with two tapered sections applies pressure at each end of keys

METHODS OF CAM MILLING—3

Use of Dummy Templets

BY H. A. FROMMELT, DIRECTOR OF INDUSTRIAL RESEARCH, KEARNEY & TRECKER CORPORATION

Production of barrel cams can be increased with a cam slide and templet to guide the cutter

THE MILLING OPERATIONS already described (*AM*—Vol. 86, pages 321 and 386) have been confined to the production of cams without using a dummy templet. Such templets are used extensively for the production of cylindrical or barrel cams, although they too can be milled by the methods previously described. For example, take the barrel cam shown in Fig. 20; here the use of a templet was impossible, because the cam is an original one to be milled. The job is performed on a horizontal milling machine, using a vertical milling attachment and a universal dividing head.

The blank for this cam was forged from SAE 4615 steel, was rough turned, normalized and finally finished turned. It was not necessary to leave material for a finishing operation because the application did not require it. After turning the blank to the specified diameter, it was coated with Prussian blue and the grooves laid out as indicated by the blueprint of the cam. The layout is used as a check during the milling operation.

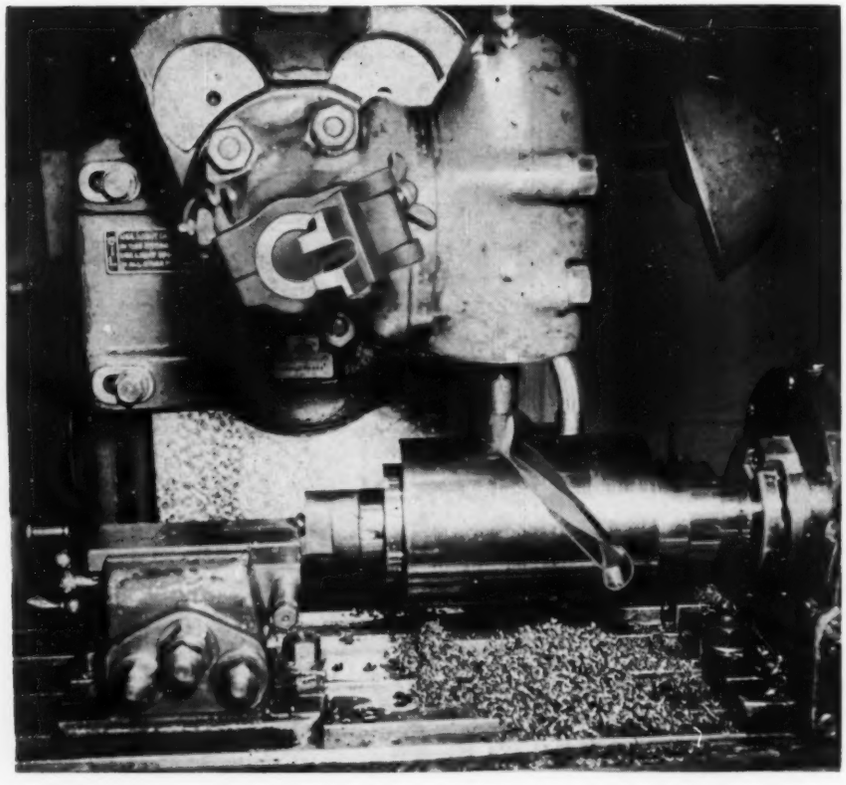


Fig. 20—Barrel or cylindrical cams, as well as plate or radial cams, can be cut readily on milling machines with the aid of a universal dividing head and the proper lead gearing

The machine is now set up and made ready for milling. The vertical milling attachment is located on the overarms and clamped to the face of the column as shown. The dividing head and tailstock are mounted on the table.

The lead gearing is now selected and the table screw drive is connected to the dividing head. From a table of leads the following set of gearing for each angle of cam groove are tabulated:

Cam groove degrees	Lead	Gearing
40 deg.	13.181	$\frac{20}{23} \times \frac{24}{38} \frac{(24)}{(8)}$
28 deg. 10 min. 21 sec.	8.413	$\frac{20}{36} \times \frac{24}{38} \frac{(24)}{(8)}$

The milling of the groove is begun by sinking the end mill to the required depth, less stock for finish grinding. The power feed to the dividing head is then engaged, which means that the blank will now be turned slowly clockwise while the table is being fed a horizontal distance equal to the lead. Translated into cam language this means that when the cam roll has traveled in the milled groove shown in Fig. 20, the rise or fall movement in the fixture will be equal to the distance the milling machine table has moved longitudinally, in this instance, to the left. Mathematically, it will be equal to the base of a right triangle whose hypotenuse is the milled groove, and whose angle between the base and the hypotenuse is 40 deg.

When the cam groove is completed, the set-up is changed to accommodate the angle of the second in the series of cam grooves; in this case, 28 deg. 10 min. 21 sec. The same procedure is then repeated as just described for the groove angle of 40 deg. Obviously, this method of cam milling is advisable

when definite lead angles are provided.

The speed of the end mill in this operation is 300 r.p.m. and the feed is 0.815 in. per min.

It should be noted that in a cam milling operation such as this, the groove should be milled to the width of the groove at the bottom, and then milled to the width of the groove across the top. Unless this is done the dimension of the groove across the top will be oversize.

The discussion thus far has been confined to the milling of original cams, that is, the milling of cams without using dummy templets. The next logical step is to discuss the milling of cylindrical cams using, in addition to the regular equipment, a dummy templet and a so-called cam slide.

Use of the Cam Slide

The nature and application of the cam slide are shown in Fig. 21. The slide is constructed like a milling machine table with tongues on the under side and grooves on the top side. The sub-base *A* of the slide is fastened to the table of the milling machine as shown. The top plate *B* of the slide is free to move on the sub-base.

A cable attached to an eyebolt on plate *B* runs over pulley *C* clamped to the milling machine table, and carries a suitable weight *D*. Since the slide is free to move over the sub-base, weight *D* will keep the slide moving to the left unless otherwise stopped.

The purpose of the cam-slide weight is evident from Fig. 22, showing a close-up of the roller bracket *E*. This bracket is attached securely to the sub-base and carries on the top of its arm cam roller *F* that slides in groove *G* of the dummy templet.

As the universal dividing head revolves, the cam roll slides along groove *G* of the dummy templet. The rise and fall movements in the groove of the templet are transmitted to top-plate *B* which is thus moved longitudinally over sub-base *A* of the slide.

When a cutter equal in diameter to the cam roll is set in the spindle of the milling machine, so that it has the same relative position as the cam roller sliding along the groove of the dummy templet, then under proper conditions of feed and speed the grooves in the dummy templet will be duplicated in the blank.

The weight attached to the cam slide will under these conditions keep the slide flush against the roller attached to the bracket and permit the roller to slide along the groove of the dummy templet.

A radial or plate cam can be used as a templet to generate a barrel cam. This application is used in conjunction

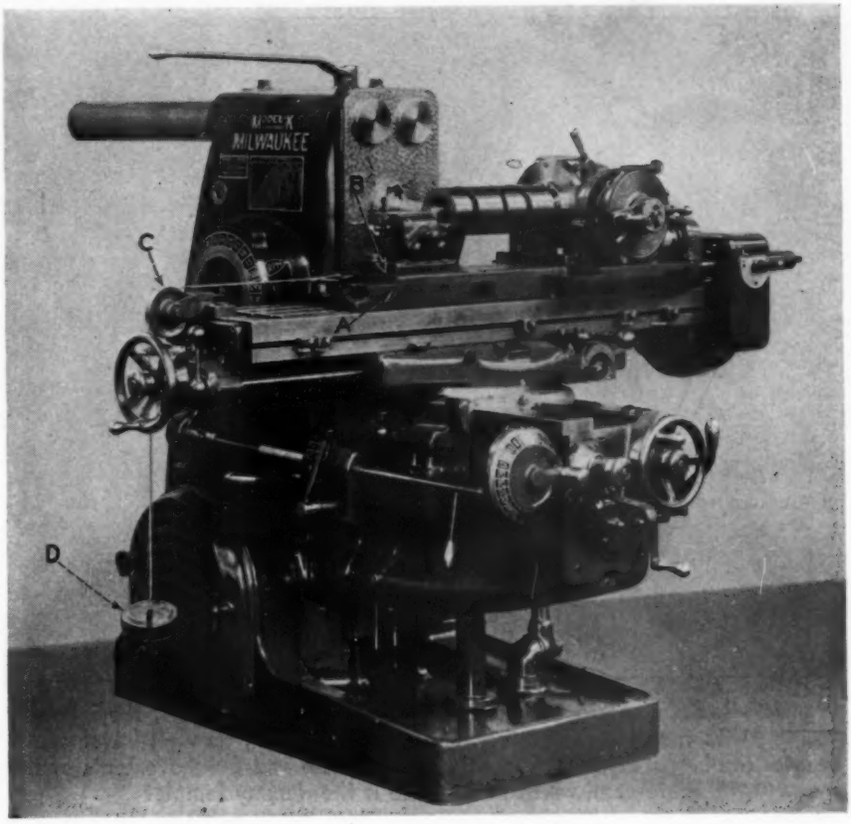


Fig. 21—A cam slide and dummy templet speeds the production of barrel cams. The dividing head, tailstock and cam blank are mounted on a sliding base that is moved by a roller running in grooves on the dummy templet

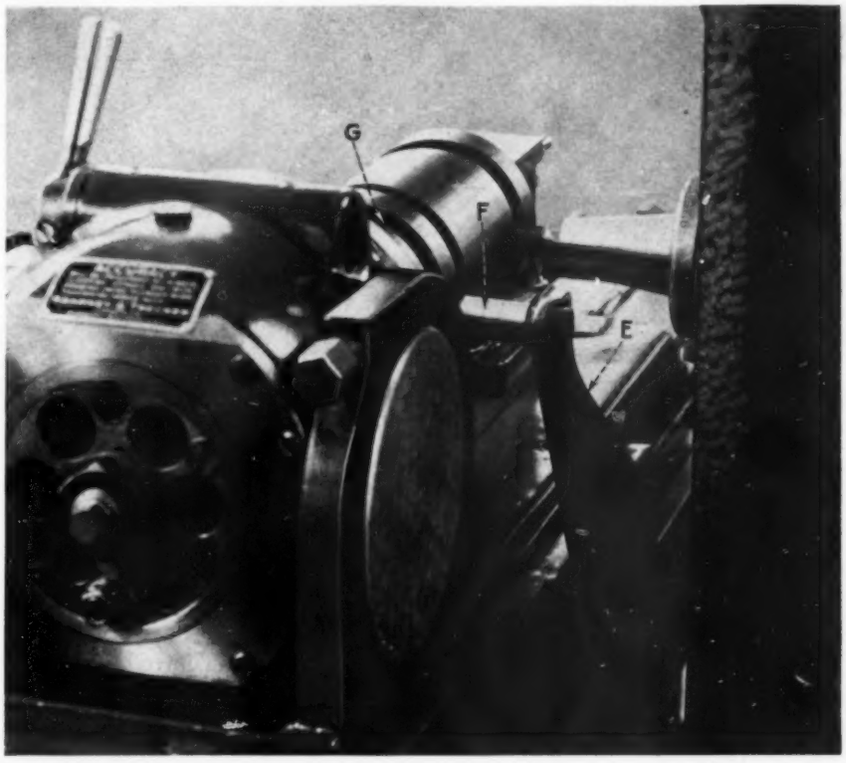


Fig. 22—A roller attached to a bracket on the base of cam slide moves in the grooves of the dummy templet. A cutter equal in diameter to the roller is set in the spindle. As the cam slide moves under the action of the roller, grooves in the dummy templet are duplicated in the cam blank

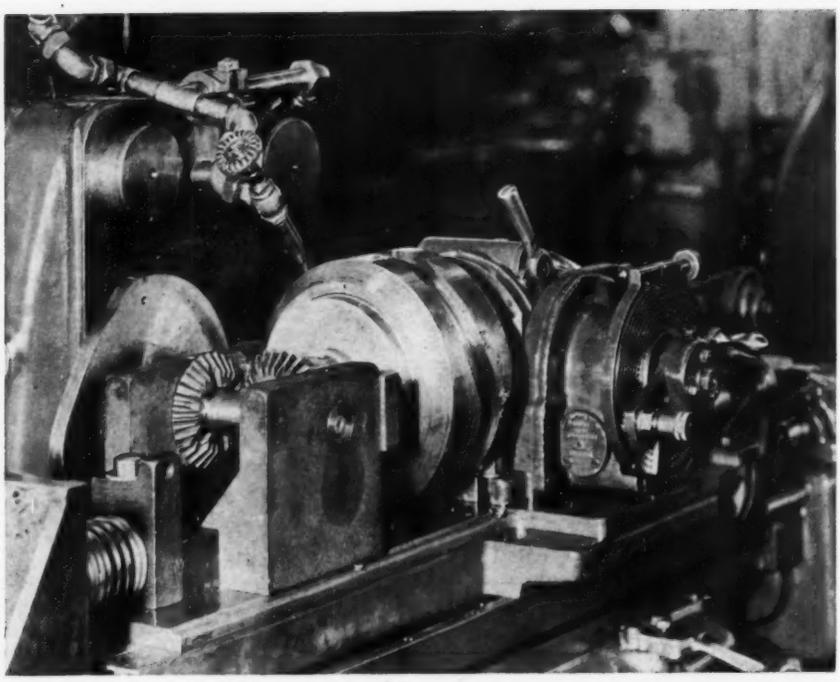


Fig. 23—Radial or plate cams can be used as dummy templets. The follower, moving with the table, actuates the plate cam which, through bevel gears, rotates the barrel cam blank to duplicate the rise and fall movements of the plate cam, which in this case is the dummy templet

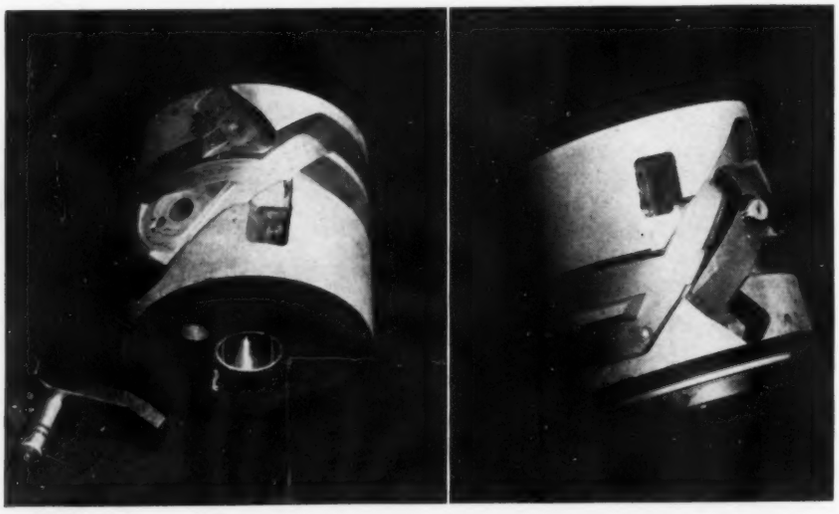


Fig. 24—Switch-track barrel cams are designed to change the movement of the cam follower in its travel, thus producing the effect of longer cams. The grooves can be cut on a milling machine when the dividing head is driven by the table leadscrew through correct lead gears

with the cam slide as shown in Fig. 23. The plate cam has the same rise and fall movements as are called for in the barrel cam to be milled. This means that the amount the cam roll will rise and fall in the finished barrel cam are identical with those given to the roller while sliding over the edge of the plate. cam.

The fixture used for this purpose includes two angle castings which support a shaft carrying a bevel gear. Another bevel gear of the same number of teeth and pitch is attached to the arbor carrying the cylindrical cam blank. When the universal dividing head, properly geared to the table screw, revolves the workpiece, the plate cam is correspondingly revolved. A cam roller held tight against the dummy templet (or plate cam) will move the cam slide an amount equal to the rise and fall movements in this dummy.

The angle plate at the extreme left of Fig. 23 is attached securely to the table of the milling machine. The spring between it and the stop block holds the plate-cam templet flush against the cam roller (not visible in the illustration). A weight attached to a cable running over a cam-slide pulley, and visible to the extreme right in Fig. 23, also assists in keeping the dummy against the roll.

Selection of Method

The circumstances surrounding each job will determine which of the three methods shown in Figs. 20, 21 and 23 is to be used for milling cylindrical or barrel cams. If a dummy templet, cam slide, roller bracket and weights are available, then this method as illustrated in Figs. 21 and 23 unquestionably is preferable. But if no dummy templet is available, then a layout and sequence of operations, similar to those for the cam shown in Fig. 20, must be used. Moreover, cam slides are not always available unless the milling of cams is a somewhat regular and customary job. Where cams are a part of the regular production, it is advisable to add this equipment to the inventory.

Cam slides make possible the milling of cams accurately and economically and are to be recommended whenever the circumstances justify their addition to the shop equipment.

An interesting variation of the barrel cam is shown in Fig. 24. The switch shown on this barrel cam is added to obtain the equivalent action of a cam twice as long. The switch changes the movement of the cam follower in its travel and produces the same effect as a longer cam. This variation of the cylindrical cam is resorted to when space is at a premium.

The milling of the cam shown in Fig. 24 is accomplished in exactly the same manner as for the cam shown in Fig. 20. The switch itself is machined according to the layout that incorporates the switch into the cam as specified.

The cam slide and dummy templet as described in this article for the production milling of cylindrical or barrel cams can be used for machining other types of cams. These include pivoted-beam and radial or plate types. The slide cam and dummy templet are also applicable to the milling of jobs which in many respects are similar to the machining of cams. Such work is the subject of the remaining articles in this series.

This is the third of a series of six articles on cam milling. The fourth will appear in an early number.

Special Stones Hone Blind Holes

BY L. P. JACKSON, DIRECTOR OF ENGINEERING, MID-WEST ABRASIVE COMPANY

MANY OF THE more important developments in the honing of metal surfaces have taken place during the past ten years. Among such refinements are automatic hydraulic feed machines; the development of Superfinish which gives us simultaneous oscillation, reciprocation and rotation; the development of new and more efficient banding agents for vitrified abrasives and the dimensional engineering of the abrasive stones so as to minimize or completely eliminate faulty work performed by earlier types.

One of the most important developments has been the prevention of taper in the honing of blind holes through the use of properly designed and properly manufactured honing stones. This trouble has not been caused by faulty honing methods, but has been largely caused by the abrasive stone itself. The stones that were being used were not designed to do the work for which they were being employed.

In honing any internal surface, the efficiency of the average stick or stone usually will vary in proportion to the amount of "overhang" allowed in performing the job. If the overhang is sufficient to permit the entire length of the stone to contact the entire area of the work there should be no excuse for taper to develop. In that happy circumstance every fractional portion of the surface to be honed is subjected to the same abrasive contact, the same abrasive speed and the same abrasive pressure. Assuming that the stones within the honing tool are of uniform hardness and assuming that the metal of the work has uniform resistance, the cut and resultant new surface thus effected should be uniform.

In blind hole honing, however, the traverse movement of the stone must end when its lower end reaches the bottom of the hole. Consequently, when stones of conventional design are used, the lower end of the hole cannot be subjected to the same cutting action given the upper area, which is contacted by the entire length of the stone. The inevitable result of such circumstances is a taper in the work.

Meanwhile, the lower end of the stone, being subjected to more work than the upper end, wears away more rapidly and accentuates the taper already in the honed surface.

Abrasive engineers tried a number of innovations. Shorter honing sticks were found to be too slow to cope with modern high production requirements. They did not completely erase the taper although they did reduce the tapered area of the hole to a slight fraction of that caused by long sticks. The use of short sticks had to be discarded although they reduced the tapered area at the bottom of the hole, because they created a concave area above it which was as bad, if not worse, than the original flaw.

Another potential solution tried, without conspicuous success, was the production of composite or segmented stones, the segments being of varying hardness so that the lower segment would cut faster than the upper.

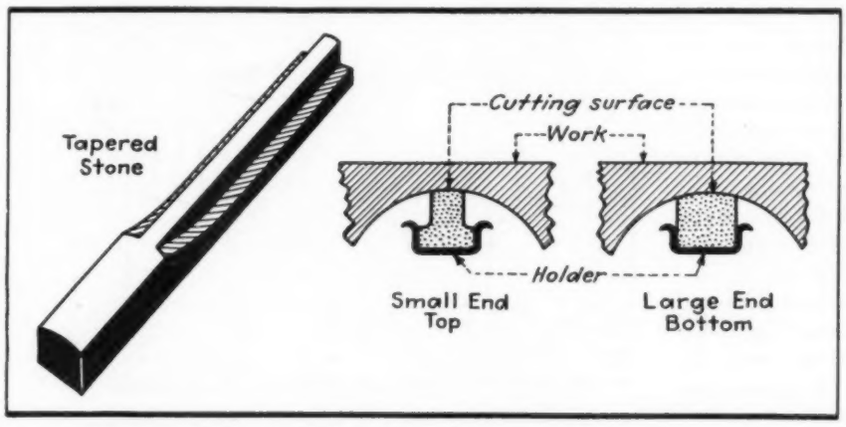
In the end, it was found that taper within the blind hole could be avoided by molding the honing stick with a taper, thus forcing the lower end of the stick to remove a greater amount of stock than the upper end.

A stone of this type must have greater tensile strength than that of the conventionally designed stone and there has to be a delicate dimensional balance between one end and the other. If the stone's dimensions at the bottom are less than they should be, taper of the hole is not completely eliminated. If, on the other hand, they are more than necessary to eliminate taper, the stone will create taper in the reverse direction.

An extensive system of trial and error has been necessary to find exactly the right amount of dimensional variance so that the increased cutting capacity of the stone at its lower end will offset precisely the loss of abrasive contact due to inaccessibility. An abrasive bond was necessary that would increase their tensile strength so that their taper would not cause them to chip or break under pressure. Such an abrasive bond has been developed and is being used in production of stones today.

At first it was necessary to make each set of stones according to specifications of a particular job, but after a considerable amount of data had been accumulated through experiment and by studying stones of this type used in actual production over a long period of time, it has become possible to specify the exact degree of taper required for a given job.

The elimination of taper in blind hole honing is only one of the problems mastered by abrasive engineers since the day of extremely close tolerances and extremely smooth surfaces dawned upon our industries. Taper difficulties also were encountered in the Superfinishing of bearings and those difficulties have been mastered in the same manner. Both blind holes and bearings can now be produced perfectly straight or, if desired for some special purpose, they can be produced with convex surfaces.



Stones which are tapered so that they are larger at the bottom where wear is greatest can be used for blind holes without producing a tapered hole

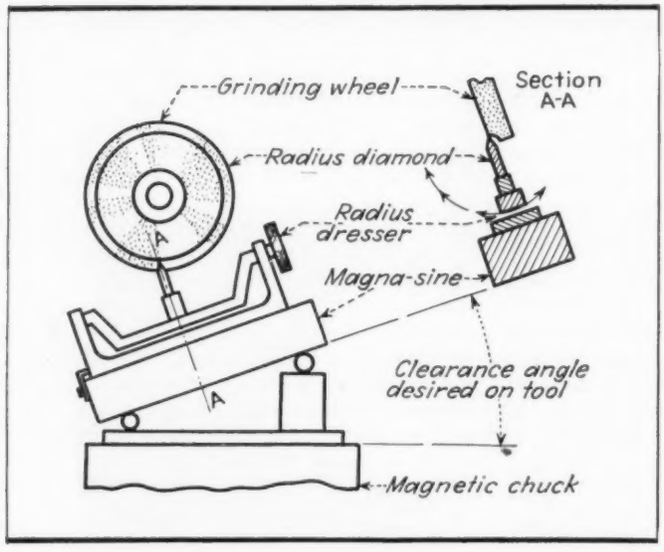
IDEAS FROM PRACTICAL MEN

Dressing Compound Angles and Radii

BY NORMAN INGALLS

Difficulty was encountered in the toolroom of our plant in dressing grinding wheels for cutting tools in which clearance caused compound angles and radii. Our method was to grind the desired radius on the tool and then grind the clearance angle free hand, leaving a small land to preserve the true radius. Tools ground in this way could not be sharpened without destroying the true radius.

On the method we have developed the radius dresser is set for the radius desired and then placed on a magna-sine as illustrated. The magna-sine is set for the same angle as desired for the front clearance angle on the tool to be ground. The table is moved under the grinding wheel until the diamond is dead center under the wheel. The radius is roughed in. The table is moved out from under the grinding wheel, and the wheel is brought down into position to dress the desired radius. The dresser is moved back under the grinding wheel until the diamond point touches the wheel; the radius is dressed. The table is advanced about $\frac{1}{32}$ in. farther under the wheel, and the radius dressed again. This is repeated until the table and dresser have passed completely under the wheel as indicated by the arrow in the drawing.



By dressing grinding wheels in this manner, cutting tools can be ground so that they can be resharpened indefinitely without destroying the true cutting radius of the tool

The radius which has been dressed on the grinding wheel is elliptical, but when it is applied on a cutting tool at the required clearance, the proper angle will result. The tool to be ground is mounted under the grinding wheel at the clearance angle and the table passed under the grinding wheel in the same manner as the dresser did during the finish dressing operation. Tools ground in this way can be sharpened by grinding straight down from the top. More time is required initially, but the tool can be sharpened repeatedly without affecting the cutting radius.

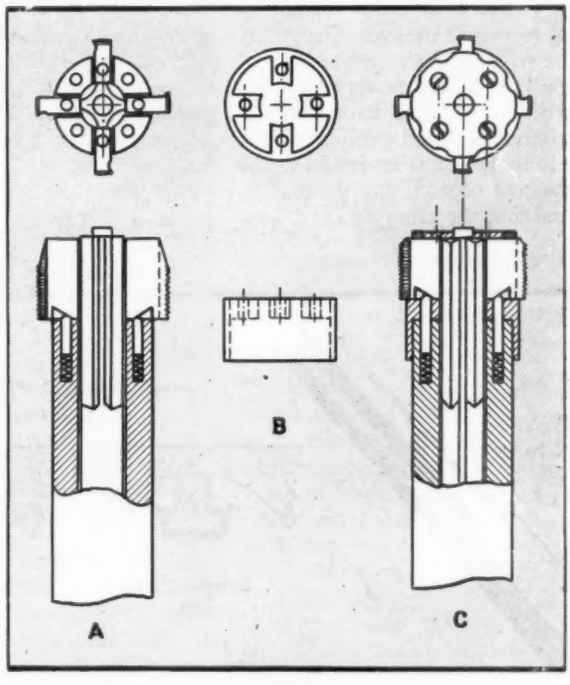
Adapter for Collapsible Tap

BY JOHN R. JONES

In the ordinary form of collapsible tap used for tapping blind holes, when the chasers are ground back a certain amount through constant sharpening, they have to be discarded.

With the use of the adapter shown in the drawing, the life of the thread chasers can be extended from 50 to 100 percent. When the chasers are worn down they are removed, the adapter is slipped into place, and the worn end of the chasers cut off so that they will fit over the adapter.

The adapter is made in the form of a sleeve which slips over the tap shank with studs which fit into the chaser slots. When the shortened chasers are replaced



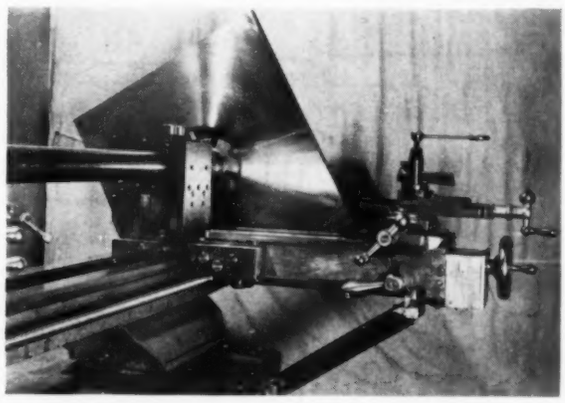
A worn collapsible tap *A* can be used much longer by using the adapter *B* and cutting off the worn portion of the chasers as in *C*

they rest on these studs. Holes through the studs accommodate the pins which collapse the tap. It is necessary to replace the original pins with longer ones to allow for the adapter thickness.

Lathe Adapted for Over-Size Work

BY PAUL C. WIEGANDT

An ordinary 12-in. bench lathe powered with a ½-hp. motor was adapted to handle work up to 54 in. in diameter by the method shown in the illustration. It was desirable not to disturb the regular tool post and slide; the attachment was therefore fastened to the end of the lathe bed. It was built up of ½-in. cold-rolled stock. An arbor fitted with a No. 3 Morse taper extends the length of the lathe. This arbor is supported at the end by a bronze bearing. This bearing was placed in position in a box built up from cold-rolled plate. After the bearing had been lined up carefully



This 12-in. lathe has been adapted to handle work up to 54 in. in diameter by using the attachment fastened to the end of the lathe bed.

with indicators, babbitt was poured around it to hold it firmly in place.

In the illustration a plate 19 in. square is fastened to the face plate. This plate is faced and ground and holes drilled in a circle around it. For this purpose the cross-slide can be equipped with a motor-driven drill and the plate indexed around the circle as required for the holes.

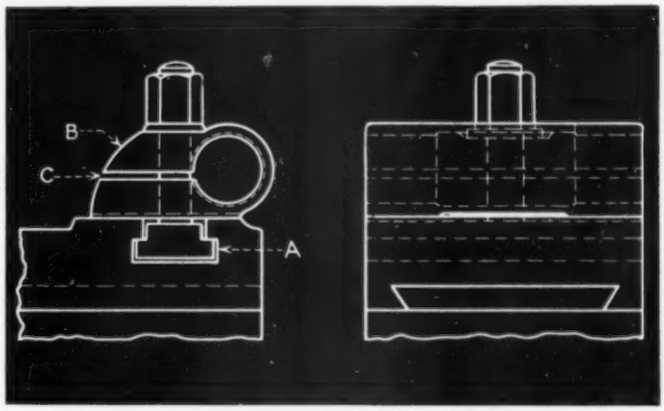
Holder Handles Heavy-Duty Boring

BY WILLIAM A. ROWELL

Heavy-duty boring can be handled with the boring bar holder illustrated. This holder seems to lack most of the faults and has all the merits of those described by Arthur Havens (*AM*—Vol. 85, p. 593), and E. W. Heinricks (*AM*—Vol. 85, p. 1142).

Anchor piece *A* fits into the toolpost slot in the toolblock. Holder *B* fits over the hold-down bolt. The bar was first held by a setscrew. This arrangement not only "burned" the bar, but lacked holding power. The setscrew was abandoned and slot *C* was cut, making one bolt do the work of clamping bar in holder and holder to toolblock.

The bore in the holder fits the largest bar to be used; split bushings provide for handling smaller bars. The center part of the bore is lightly counterbored to provide a two-part bearing on the bar. Similarly the



Boring bars are quickly clamped and firmly held in this simple holder designed for heavy-duty boring

base is cut away at the center to provide a two-part bearing on the toolblock.

Originally the holder was provided with a key that engaged the slot in the toolblock. This was abandoned because it was sometimes necessary to bore a hole with a taper near the bottom. If the compound was set to bore the taper, the whole bar stood at the taper angle and would not enter the parallel part of the bore. Without the key, it has been found that the holder does not rotate around the hold-down bolt.

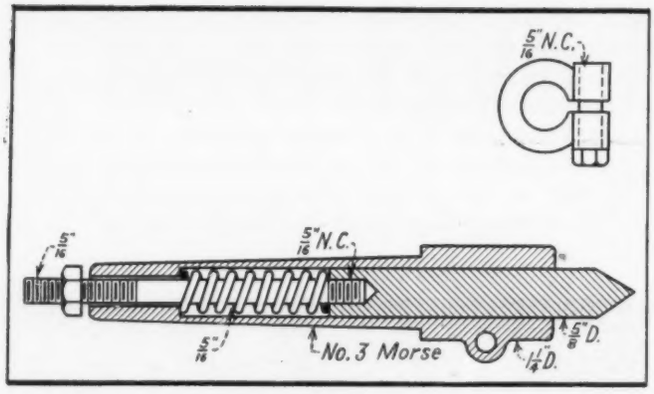
This holder is simple in design, easy to build, and strong in operation. Tightening the single bolt provides firm clamping of the bar and holder at two different points in a single operation.

Spring Center For Lathe Grinding

BY F. F. ANDERSON

Recently we had to grind several hundred small pieces between centers. As we had no small grinder available we decided to use a lathe. In order to regulate the center distance we built the spring center illustrated in the drawing. By building the center with a No. 3 Morse Taper we were able to use it in any of our lathes.

The shank and body were turned from a piece of cold rolled steel, then the taper was driven into the sleeve of a headstock so the hole for the center could be bored and the rear hole drilled. The center pin was made from drill rod and hardened and ground at the point. A spring behind the center gives any needed pressure and can be adjusted to any position. The threaded rod at the back prevents the center from



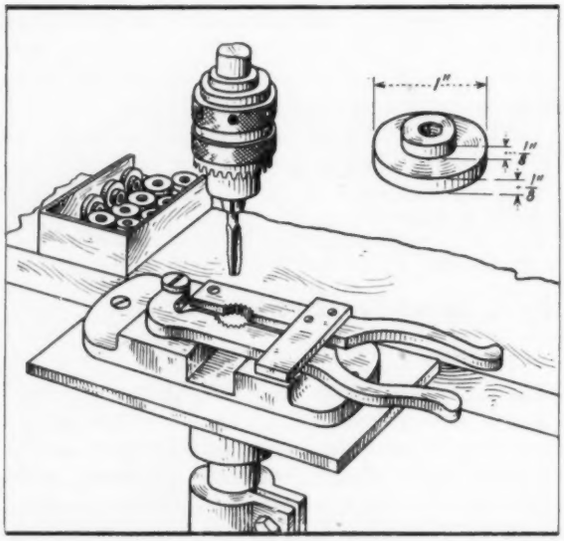
For grinding several hundred parts between centers on a lathe this spring center was built for quick loading and unloading of parts

being pushed out when the work is removed. The cross clamp on the outer end was welded before the boring operation to eliminate warping. This clamp can be used to clamp the center solid or to take up wear. In operation the work is used to open the center instead of a side lever.

Fixture Helps Tap Vulcanized Fiber Washers

BY C. H. WILLEY

The tapping of vulcanized fiber washer-nuts was speeded up by the use of a simple fixture. A hundred thousand of the washers 1 in. in diameter and $\frac{1}{8}$-in.



Fiber washers are conveniently held for tapping in this pliers-type fixture

thick with a shoulder of smaller diameter another $\frac{1}{8}$-in. thick were to be tapped.

The fixture is designed to operate like a pair of pliers. The jaws are made to fit the washers and serrated to grip the fiber firmly. One jaw is fixed and one is movable. The operator places the washer in position against the fixed jaw with his left hand, while with the right hand he closes the movable jaw. With the right hand holding the two handles together, the tapping is done.

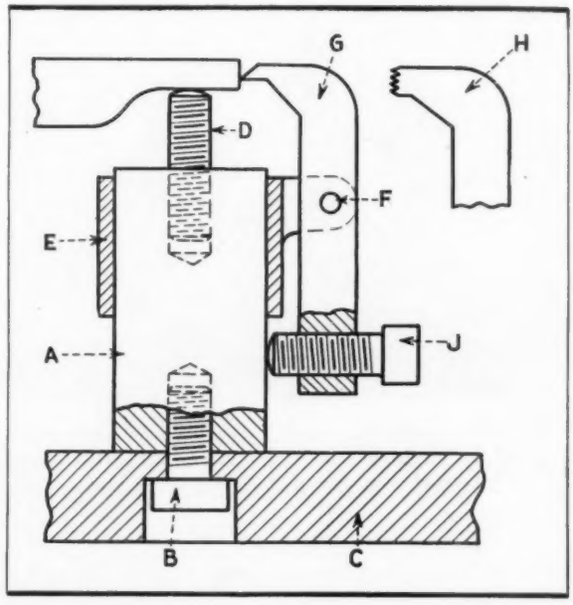
After tapping the movable jaw is opened and the washer flicked off down an incline under the movable jaw and into a container.

Clamping Device Holds Castings

BY EUGENE GROSZ

A universal clamping unit, such as shown in the drawing, is a handy tool for holding rough castings and plates on a milling machine table for first operations. With several such units available, it is often possible to avoid the use of a special fixture.

The clamping unit body is cylindrical block *A* which is tapped in the bottom for screw *B*. Screw *B* fits the



Rough castings can be held in position on milling machine table by these universal clamping units

slot in milling machine table *C*. Jack screw *D* in the top of block *A* is adjustable for height and serves as a rest for the casting. Sleeve *E* is free to slide up and down the cylindrical block. A lug on this sleeve has pin *F* which serves as a fulcrum for the clamp proper.

This clamping bar can be equipped with knife edge *G* or serrations *H* as required. Screw *J* is tightened to clamp the casting.

As many clamping units as are required can be spaced at intervals around the casting to be clamped. The block is fastened to the table and jack screw *D* adjusted to the proper height to serve as a rest. The sleeve is moved up until the clamping surface is in the proper position and the screw *J* tightened to clamp the casting in position.

Armament

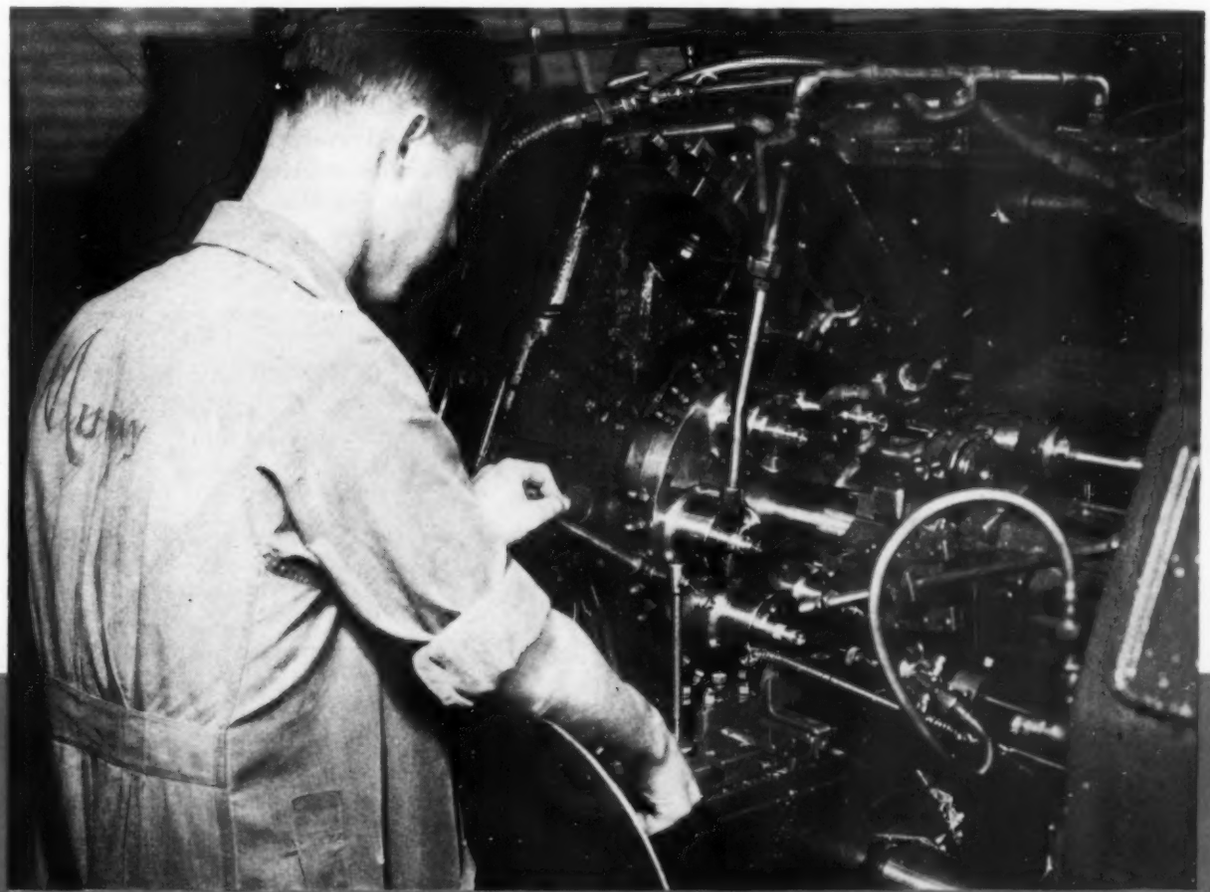
SECTION OF AMERICAN MACHINIST

This article has been reviewed and approved by the proper military authorities

Percussion Fuze for Small Shell

OUT OF CANADIAN PLANTS are flowing more and more of the tools of war that eventually will be a major factor in the defeat of the Axis nations. In a number of instances, the plants now making war material in Canada have been specially retooled, but in others much of the existing equipment has been used to advantage. An outstanding example of this is the Canadian plant now turning out large quantities of the small percussion fuze used on 40-mm. high-explosive shell. For many years, this plant has been making screw machine products for the automotive and other mass-production industries, and a number of its machines were found suitable for operations on fuze parts. Even so, it was necessary to purchase and install a number of units for finishing operations on the parts turned out by the screw machines.

In this plant, the three main body sections of the fuze, as well as a number of internal parts, are ma-



A number of six-spindle Model RA-6 Acme-Gridley automatics are employed for machining operations on many of the major parts for the 40-mm. fuze. The set-up shown is for the first operations on the head. Directly in front of the set-up man's right hand is the special tool carrier for turning the radius on this piece

chined from bar stock in six-spindle Acme-Gridley automatics, while such parts as arming sleeves, ferrules, shutters, needles, retaining plugs, pins and detonator plugs are produced in No. OG Brown & Sharpe single-spindle automatic screw machines. While most of the screw machines are operated by men, a large number of girls are employed for "second operation" work and the inspection operations necessary to insure continued production of parts within the tolerances allowed. In all, about 90 percent of the employees in the fuze department in this plant are girls who have been brought in and given a short training course to familiarize them with the work they are called on to do.

Each Part Must Be accurate

There are 22 major aluminum, brass and steel parts in the fuze being made in this plant. These are assembled into a unit weighing only about 4 oz. Viewed in the light of the huge parts that go into tanks and fighting ships, not one of these fuze parts is very large. Nevertheless, it is important that each be made accurately in order that the fuze will function properly after the shell has been fired.

The three largest parts in the 40-mm. fuze are listed as the Head, Body I and Body II. Each of these is made of an aluminum alloy which must be watched carefully during the machining operations, as it has been found to tear easily and sometimes crumble under the pressure of the cut, particularly at high speeds. Experience with this alloy has shown that the cutting tools must be ground and honed carefully to provide a smooth cutting face, and minimize pick-up of the alloy on the cutting face. It is better to set up with two or three small tools than to use a wide form tool. The built-up edge on wide tools scores and scratches the work badly. Back rake on the cutting tools should be about 20 to 25 deg., while side rake should be about 8 to 10 deg.

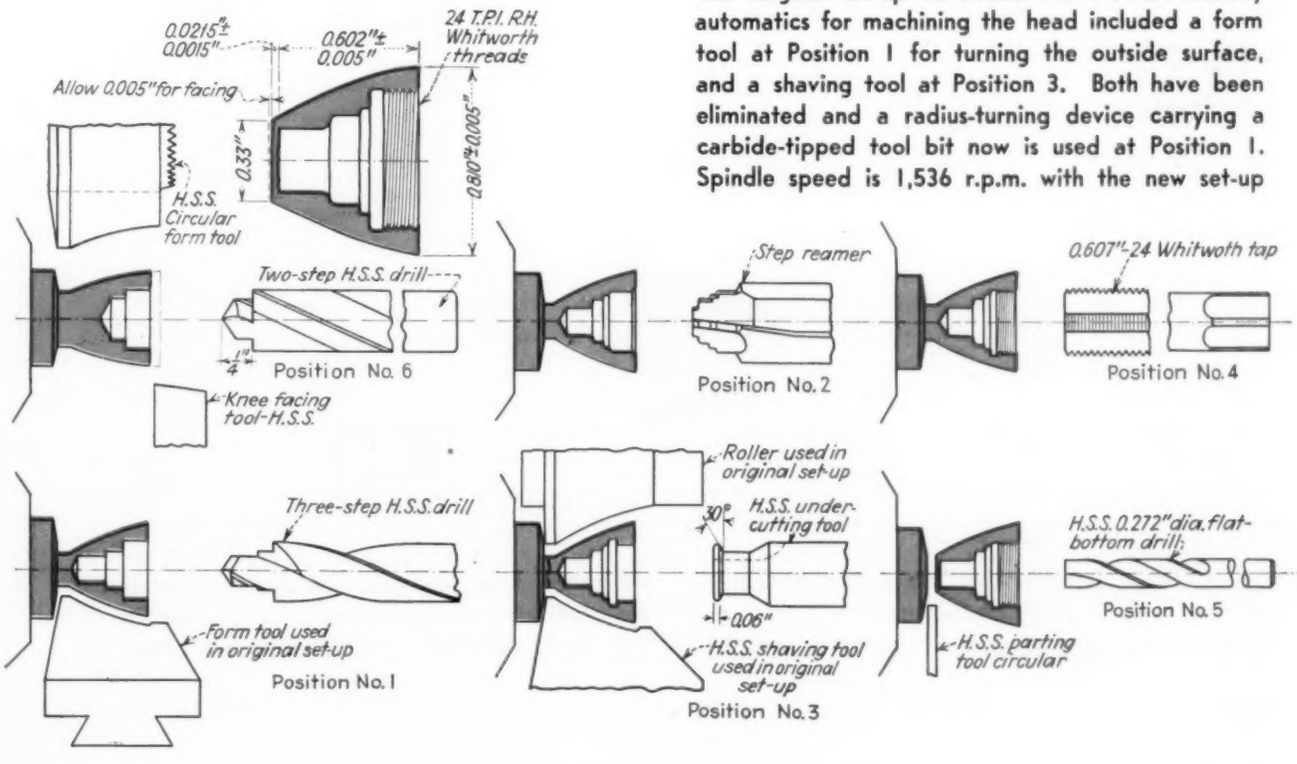
The head is formed, drilled, reamed, tapped and cut off in $1\frac{1}{4}$-in. Model RA-6 Acme-Gridley automatics set up with 18-4-1 high-speed steel tools, and using a coolant made up by mixing one part Tycol with three or four parts paraffin oil. With a spindle speed of 1,536 r.p.m., and a feed of 0.006 in. per rev., these parts are turned from $\frac{27}{32}$-in. diameter round aluminum bars in a 9-sec. cycle. As shown in the accompanying sketch, the cycle of operations is as follows:

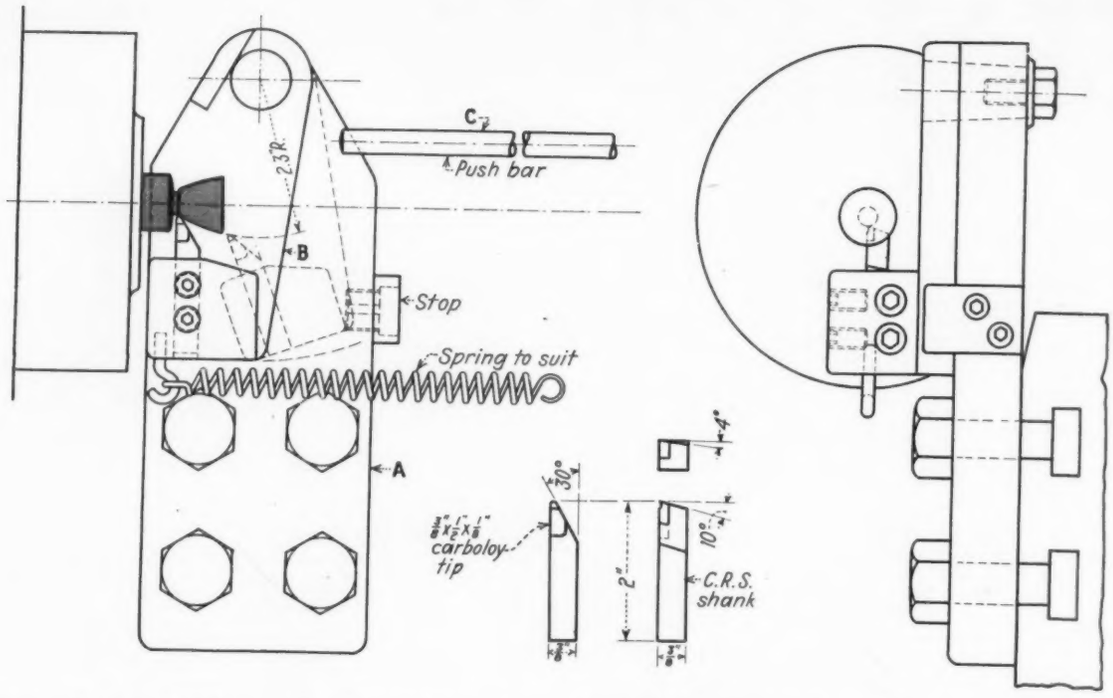
At Position 6, the body of the head is roughed with a high-speed steel circular form tool, while the end of the bar is being drilled with a two-step drill and is being faced with a high-speed steel bit on the knee slide. Then, at Position 1, the outside form is finish turned with a carbide-tipped bit in a special radius-turning holder carried on the tool slide, shown on a separate sketch, while a three-step high-speed steel drill is used to semi-finish the inside diameters. In the original set-up, a dovetail-type high-speed steel form tool was used for semi-finish turning the

Arming sleeves, ferrules, shutters, retaining plugs and a number of other parts are turned out in large quantities on B. & S. No. 0G single-spindle automatics. Girl inspectors check every piece—each inspector secures parts from the machine, suspends them in a wire basket in the degreaser shown in the background, then takes them to a bench for checking

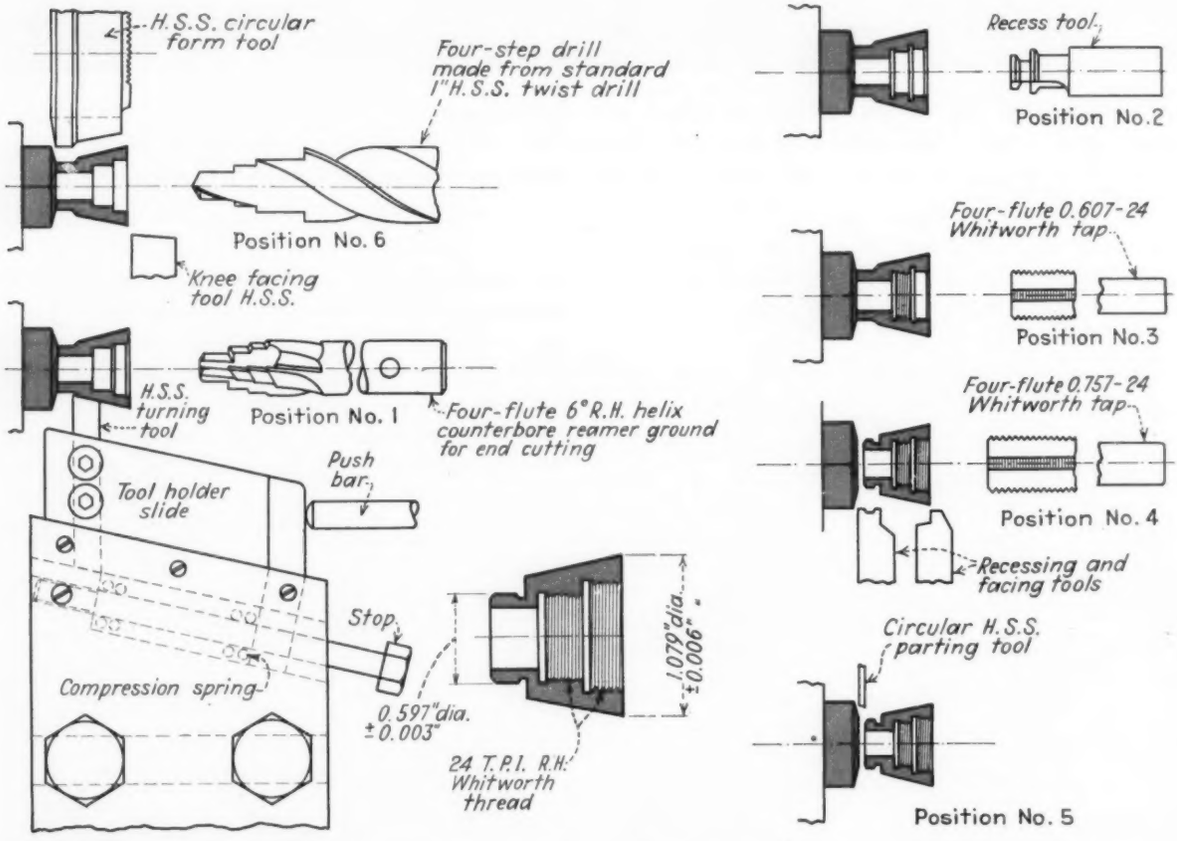
Small needles for the 40-mm. fuze are machined from 0.090-in. ground stainless steel bars on Tornos single-spindle automatics. High-speed steel tools with 15-deg. back rake form and cut off needles in an 18-sec. cycle with a spindle speed of 4,400 r.p.m. Only two bench operations are necessary to finish the pieces

The original set-up on Model RA-6 Acme-Gridley automatics for machining the head included a form tool at Position 1 for turning the outside surface, and a shaving tool at Position 3. Both have been eliminated and a radius-turning device carrying a carbide-tipped tool bit now is used at Position 1. Spindle speed is 1,536 r.p.m. with the new set-up





Turning of the head with a single-point tool provides a better finish than was possible with a form tool. When the cam brings the tool slide at Position 1 forward, fixture *A* is in position so that the pivoted tool block *B* carrying the tipped bit is traversed in an arc across the work by pushbar C on the slide



Acme-Gridley operations on the center section of the fuze body are indicated above. Accuracy and finish of the outside surface were improved by eliminating form tools used in the original set-up and substituting the taper turner shown at position 1. High-speed steel tools are used at all positions

outside form, as shown in the tool layout, and the form was finished by shaving at Position 3. When the radius-turning fixture was installed to eliminate scoring caused by the built-up edge on the form tool, it was found that the shaving tool and roller at Position 3 could be eliminated.

At Position 2 in the machine set-up for heads, the internal diameters and radii are finish-reamed with a high-speed steel four-flute special step reamer made from Circle C steel, hardened and ground all over. All of the diameters finished by this reamer must be held within 0.001 in. As with all other parts for the fuze, an effort is made to hold parts to the mean dimensions specified on parts drawings in order to make certain that sufficient clearance is left for easy assembly of the various parts. At Position 3, a high-speed steel undercutting tool is used to cut a recess at the bottom of the largest internal diameter. The 0.050 in. wide recess is undercut to a diameter of 0.605 in. within plus or minus 0.005 in.

A four-flute 0.607″-24 Whitworth ground-thread solid tap is used at Position 4 to cut the threads in the largest internal-diameter of the head. Finally, at Position 5, the bottom of the smallest inside diameter hole is finished, and the piece is cut off from the bar stock. The flat-bottom drill finishes its cut and is returned from the piece before the high-speed steel circular parting tool is advanced. Upon return of the parting tool slide, the stock is fed forward against a swing stop.

Quick Check Reduces Scrap Loss

Finished pieces are gathered from the machine by a girl inspector and carried to a degreaser in a wire-mesh basket. After cleaning a small lot of pieces, she takes them to an inspection bench and makes a 100 percent check of all dimensions. By providing a large group of inspectors in this department, it is possible to have the parts made on the various automatics checked soon after they are finished. This permits taking care of any inaccuracies in the tooling set-ups almost as soon as they occur, and reduces scrap loss to a minimum.

The aluminum-alloy center section of the fuze body, known as Body I, is formed, drilled, counterbored, faced, recessed, tapped and cut off in $1\frac{1}{4}$-in. Model RA-6 Acme-Gridley automatics set up with high-speed steel tools as shown in the accompanying sketch. This piece is turned from $1\frac{3}{32}$-in. diameter round bar of the same aluminum alloy as used for the head. In this set-up, the spindle speed is 1,047 r.p.m., feed is 0.006 in. per rev., and the cycle requires 11 sec. Tool layout is as follows:

At Position 6 the piece is rough formed with a high-speed steel circular form tool having a 15-deg. back rake like the roughing form tool used for the head. While this tool is cutting, the inside diameters are roughed out with a special four-step drill, and the end of the piece is faced with a high-speed steel bit on the knee slide. In the original set-up a $\frac{27}{64}$-in. drill was used at this position, but experience showed that better efficiency could be obtained from the four-step combination counterbore-reamer at Position 1 if the several inside diameters are roughed out first.

Special Taper-Turning Device

As in the set-up for the head, the original tool layout for Body I called for the use of a finish form tool at Position 1, and a shaving tool at Position 3 to finish the outside surfaces. Since then, it has been found best to substitute a taper-turning device for the finish form tool, and to eliminate the shaving tool. While the outside diameter is being turned at Position 1, a combination counterbore-reamer ground for end cutting is used to finish the three inside diameters. Then, at Position 2, a double under-cutting tool cuts recesses at the bottom of the two largest inside diameters.

At Positions 3 and 4, these two diameters are tapped with four-flute solid Whitworth taps carried in two-speed units on the center slide. High-speed steel tool bits at Position 4 form the small outside diameter and finish face the large end of the piece, while the largest internal diameter is being tapped. Then, at Position 5 the piece is cut off from the bar stock with a circular high-speed steel parting tool. These pieces then go through the same inspection cycle as described before, 13 gages of several sizes and types being used to insure delivery of accurate parts to the following machine operations.

Largest of the three aluminum-alloy parts which make up the main body of the 40-mm. percussion fuze, Body II is formed, drilled, faced, reamed, recessed, tapped, threaded and cut off in $1\frac{5}{8}$-in. Model RA-6 Acme-Gridley automatics set up with high-speed steel tools. This part is turned from $1\frac{5}{16}$-in. diameter round bar stock of the same alloy used for the two other parts of the body. For the tool layout shown in the accompanying sketch, spindle speed is 994 r.p.m., feed is 0.0063 in. per rev., and the machining cycle requires 15 sec. Tooling layout now is as follows:

The outside surface is rough formed with a high-speed steel circular form tool, the end of the piece is turned with a knee tool bit and a two-diameter drill is used to rough out the inside surfaces at Position 1. Then at Position 1, a $\frac{33}{64}$-in. diameter drill is employed to finish the small inside diameter and the tapered body is turned with a single-point tool bit in a special slide holder. At Position 2, a four-flute com-

bination counterbore-reamer ground for end cutting finishes the three largest inside diameters, and at Position 3 a recessing tool undercuts at the bottom of the largest inside diameter to prepare the piece for the tapping operation which follows. Also at Position 3, two high-speed steel form tools finish turn the piece at each end of the tapered section. Finally, at Position 4 a four-flute tap is used to thread the largest inside diameter, and at Position 5 a circular-chaser type die head cuts a 1.191″-14 Whitworth thread on the large end of the piece. When the die head has been withdrawn from the work, a circular cut-off tool is fed in to complete the operations on this part. When this tool is returned, the stock is fed forward against a swinging stop. A total of 15 gages are required to inspect each of these pieces when it is removed from the machine.

Machining Brass Striker Guides

Made in both 1-in. Model RA-6 Acme-Gridley six-spindle automatics, and No. OG Brown & Sharpe single-spindle automatics, the brass striker guide is drilled, counterbored, threaded, formed and cut off from $\frac{5}{8}$-in. round bar stock. The tooling set-up for machining this part on the single-spindle automatic is shown in an accompanying sketch. For the six-spindle machine, the tooling is arranged as follows:

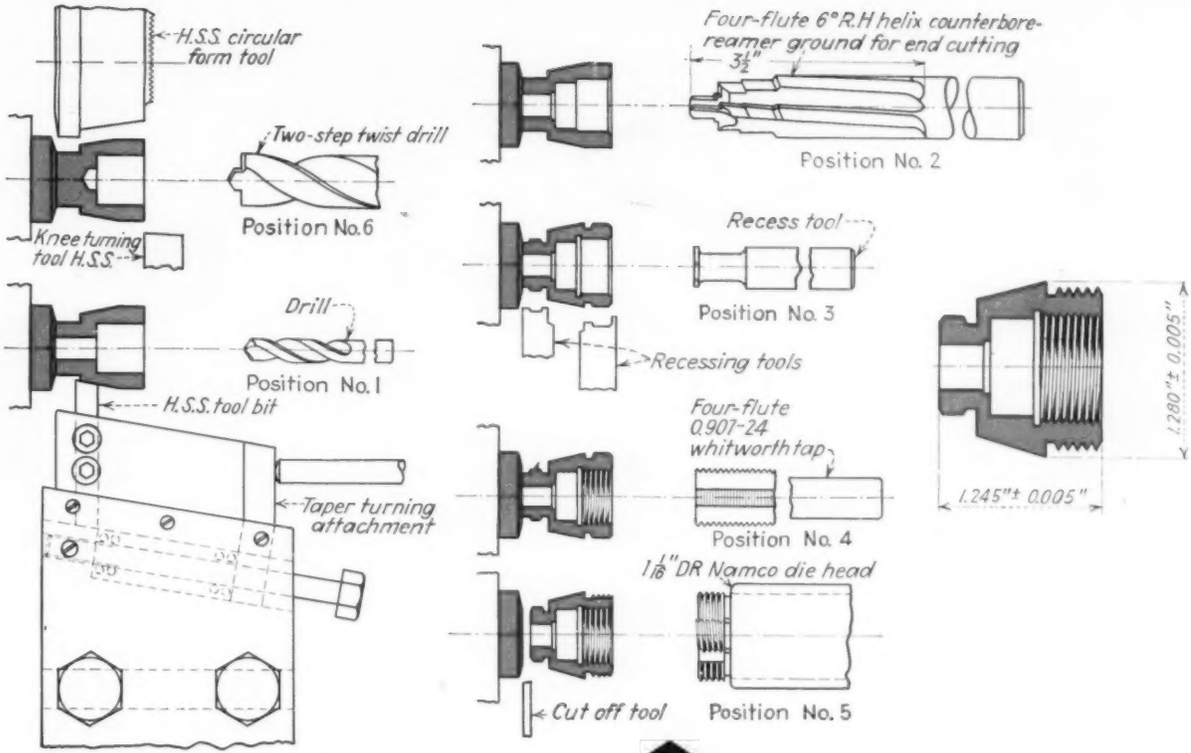
At Station 6 the body is rough formed with a circular high-speed steel form tool, and the end of the bar is centered with a spotting drill. Then at Position 1, the outside diameters are finish formed with another circular form tool and the body is drilled to a depth of 0.284-in. with a 0.0935 in. drill. Next, at Station 2 a 0.052 in. drill is used to extend the hole through the entire length of the piece. This small drill is carried in an air-driven head to provide the proper drilling speed. At Station 3 the large outside diameter is threaded with a 0.600″-24 Whitworth self-opening die head. Finally, at Station 4, the large hole is finished with a special drill which forms the 0.031-in. radius connecting the large and small diameter holes, and high-speed steel bits are employed to chamfer at each end of the thread on the large diameter. At Station 5 the piece is cut off with a high-speed steel circular parting tool. For this six-spindle machine set-up, spindle speed is 2,516 r.p.m., feed is 0.004 in. per rev., and the machining cycle requires 5 sec. In this machine, as in all other automatics in this department, the same coolant is used as was specified for the set-ups for the three aluminum body pieces. After the striker guides have been completed, they are gathered, degreased and inspected with eleven gages.

A large number of high-speed bench lathes, second-operation lathes, and bench drill presses are employed for the finishing or "second" operations on the fuze parts produced in single- and multiple-spindle automatics. The aluminum-alloy fuze head, for example, goes from the automatic to a Hardinge second-operation lathe where the small end is faced off to a thickness of 0.0215 in., 0.005-in. stock having been left on the head end for this facing operation. A high-speed steel tool bit ground with a large nose radius, and having no side or back rake, is fed across the piece while mounted in a tool post on the lever-operated cross-slide. A special threaded arbor is used to hold and locate the piece, the arbor having an extension pilot which fits snugly in the small diameter inside the head and contacts the closed end to center and locate the piece. Spindle speed is 3,900 r.p.m. for this operation. After the tool has been returned, a pad of emery cloth is used to remove burrs and sharp edges before the piece is taken off the arbor.

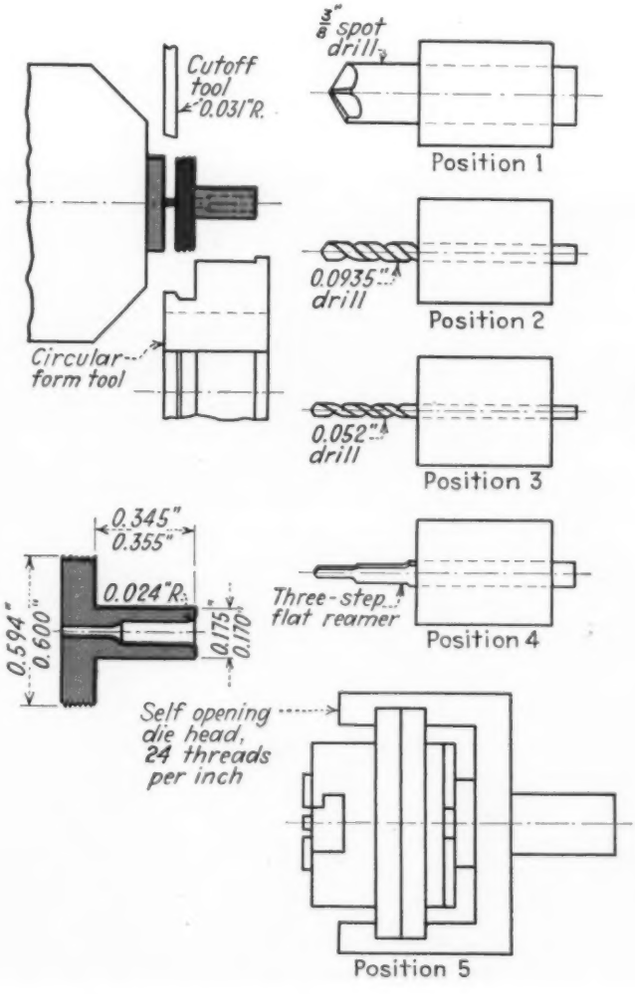
Following each second operation, the fuze parts are inspected at benches placed in the line adjacent to the machines. In most instances, this inspection is 100 percent, but in a few cases where the operation does not affect the accuracy of the part, only about 10 percent of the parts are checked. Heads that have been faced in the operation just described go to a preliminary inspection bench where undersize four-flute counterbores are used to remove the burr inside the head at the start of the thread. Then the parts are checked with go and not-go gages and are racked in trays for delivery to a conveyor-type degreasing machine. All of the fuze parts pass through this machine before final inspection, the brass parts also going through an acid dip to insure that all surfaces are thoroughly cleaned. The aluminum parts are anodized in Hanson-Van Winkle-Munning equipment. Then the parts pass through a final shop inspection group and the final army inspection room before delivery to the assembly department.

Second Operations on Fuze Body

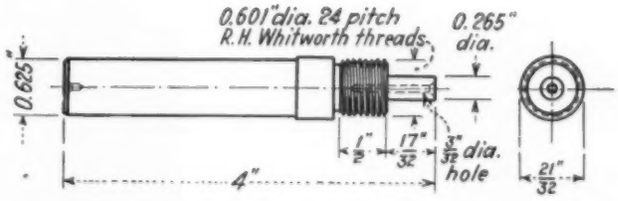
Four second operations are necessary when finishing the center section of the fuze body, known as Body I. First, a two-diameter, four-flute, end-cutting counterbore is used in a bench drill press to remove burrs at the start of the two tapped diameters. Next, the small outside diameter is faced, turned and recessed in a Hardinge lathe. This lathe also has a spindle speed of 3,900 r.p.m. The lever-operated cross-slide has a tool post at each end. Two high-speed steel tool bits on the rear post are fed forward by hand to finish face the large end of the piece, and face and recess the small end. Then, the cross-slide is fed toward the rear against a stop so that the lever-operated compound slide at the front of the cross-slide can be traversed by hand to finish turn



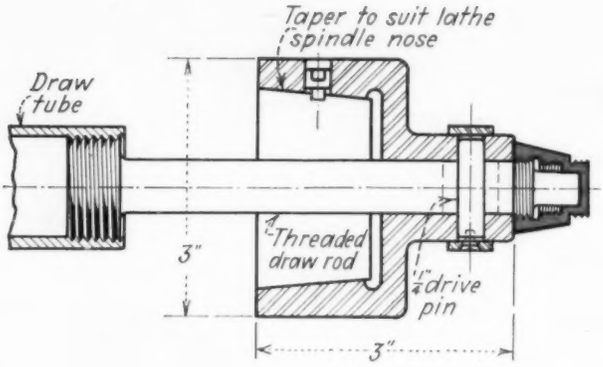
A 1⅝-in. capacity Model RA-6 Acme-Gridley is used for turning Body II pieces from 1 5/16-in. round aluminum-alloy stock. Spindle speed is 994 r.p.m. and the machining cycle requires 15 sec. Tools must be kept sharp



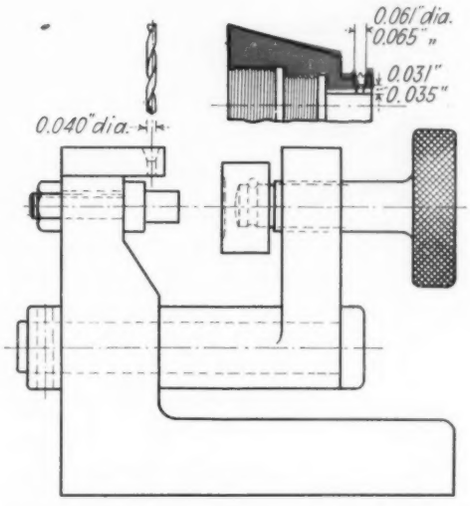
Brass striker guides are machined from ⅝-in. round bar stock in single- and six-spindle automatics. This tooling layout is for a No. 0G Brown & Sharpe



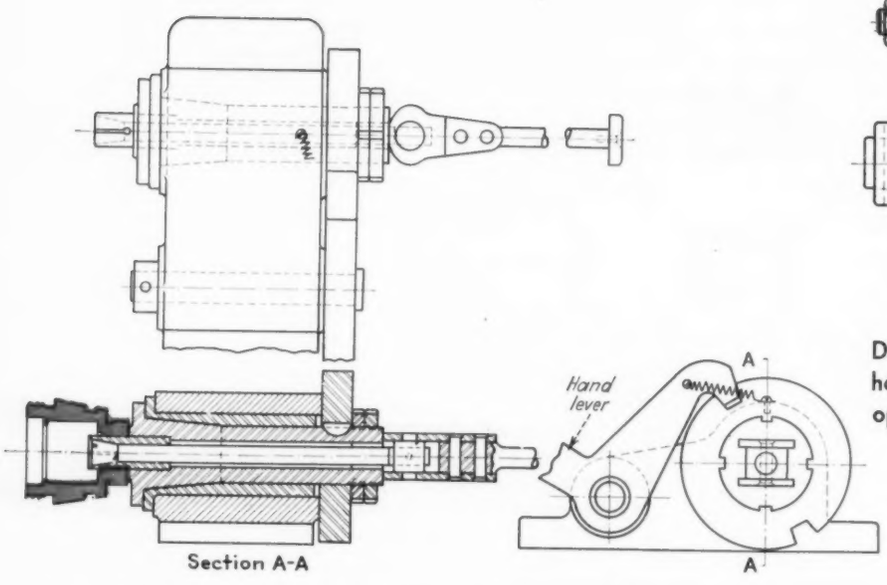
This hardened and ground tool steel arbor locates and drives the fuze head in a Hardinge second-operation lathe for a facing operation



A special draw-back threaded arbor centers and drives Body I pieces when threading the small end with a self-opening die head in a Hardinge lathe



Drilling and counterboring the lock pin hole in Body I involves two bench drill operations. Simple fixtures are employed



A two-position indexing fixture is used when milling wrench slots in opposite sides of the tapered body piece for the 40-mm. fuze

Lever-operated fixture and table on this No. 3 Burke bench miller speed up the milling of wrench slots in Body II. Girl operators wear overalls, or slacks, and bandanas; they cannot wear jewelry

the tapered body. This compound rest is set at an angle of 11 deg. 41 min. and carries a carbide-tipped tool bit which has a ¼-in. nose radius and a 5-deg. back rake angle. Each part finished on this lathe is inspected at a nearby bench.

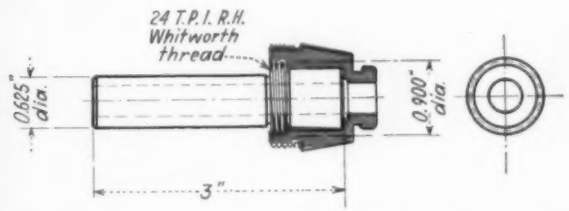
Next, the Body I piece goes to another Hardinge second-operation lathe where the 0.597-in. diameter at the small end is trued up and threaded with a self-opening die head carried in a turret mounted on the tailstock slide. Since only one turret position is used, the six-station turret is locked so that it will not index. A high-speed steel tool bit carried on the lever-operated compound rest is used for truing up the outside diameter before it is threaded. For this operation, the piece is centered and driven by a special draw-back arbor mounted in the spindle of the lathe. Design of this arbor is shown in an accompanying sketch. Spindle speed for this operation is 1,900 r.p.m. A 100 percent inspection follows this operation.

Final machine operation on Body I is the drilling and counterboring of a lock pin hole at right angles to the axis of the piece at the small end. Originally, this operation was performed in a single-spindle drill press, using a two-diameter drill. Now, two bench drill presses are used, and the drilling and counterboring operations have been separated. First, a 0.040-in. hole is drilled all the way through the piece and then, in the second drill press, a 0.063-in. diameter hole is counterbored about half way through. Simple fixtures are employed for these two operations, the first having a screw clamp to hold the piece in position, the second merely having a stud to support the piece, while the piloted counterbore enters the previously drilled hole. Both spindles are run at 5,000 r.p.m., and are fed by hand. Burrs are removed by hand using fine files.

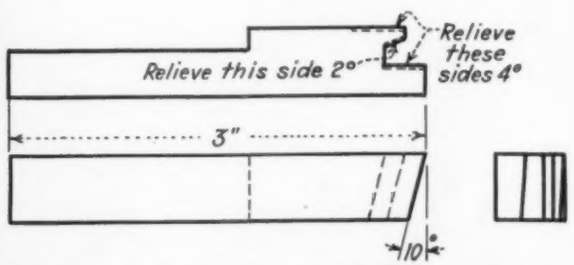
A total of seven machine operations are required to finish the largest fuze body sections, listed as Body II, after they leave the six-spindle automatics. First, burrs are removed from the smoke chamber in a Delta bench drill press, using a piloted eight-flute counterbore. Next, two spanner wrench slots are milled in opposite sides of the large tapered diameter, using a No. 3 Burke bench miller equipped with a special indexing fixture. The 4-in. diameter ⅛-in. wide high-speed steel cutter is rotated at 2,500 r.p.m., one slot being cut at a time. A nearby shop inspector checks about 10 percent of the parts following this operation.

Third operation on Body II involves the facing and recessing of the small end in a Hardinge second-operation lathe, the piece being centered and driven by a screw-type arbor. During this operation, the tapered body is finish turned with a carbide-tipped

Hardinge second-operation lathes running at 3,900 r.p.m. are employed for finishing the outside taper on Body II pieces. The small end is faced and undercut in the same set up



Only 0.001-in. wear is allowed on the pilot of this arbor which holds Body II pieces while finish turned



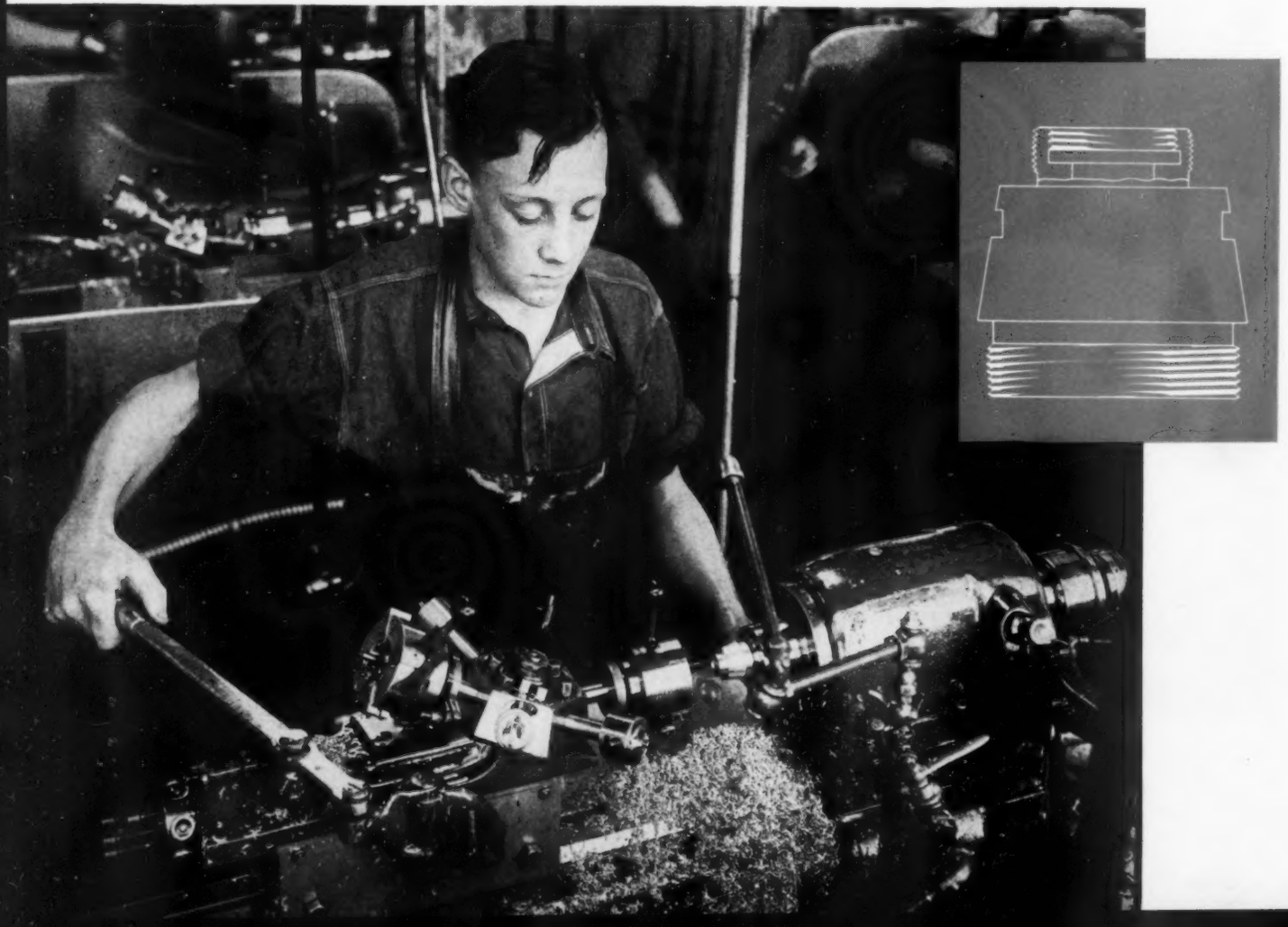
The form tool for recessing and facing the small end of Body II pieces is made from ½-in. square stock

tool on the lever-operated compound slide on some of the lathes, and on a screw-operated compound slide on other machines. For this operation the lathe is run at 3,900 r.p.m., and the part is held on a hardened and ground threaded arbor, having a pilot to fit in the 0.800-in. internal diameter of the piece. In the rear tool post is mounted a form tool made of high-speed steel which is brought forward by the cross-slide lever to face the small end of the piece, and undercut the small end for threading in the next operation. When this cut has been completed, the cross-slide is moved back against a stop and the compound rest is traversed to finish turn the tapered diameter. A carbide-tipped tool with a round nose is used for this cut. All tools on these second-operation machines are checked at frequent intervals by the set-up men, and only 0.001-in. wear is allowed on the pilot of the arbor in this lathe, in order to insure continued accuracy. About 10 percent of the parts finished in this operation are checked by a shop inspector before they are passed along to the next machine.

The next operation on Body II pieces also is performed in Hardinge second-operation lathes, the small end being counterbored and recessed with high-

Another Hardinge second-operation lathe set-up counterbores and recesses the small end of Body II pieces. Lever-operated slides simplify the operation

Geometric self-opening die heads, solid four-flute taps and high-speed steel chamfering tools are set up on the tilted turret of this Hardinge lathe for threading the small end of Body II pieces



Identifying data is impressed on the tapered outside diameter of Body II in this machine. Another girl, at a bench beside this machine, removes burrs by drawing the pieces across a sheet of emery cloth

speed steel tools. The arbor used is like that employed for the previous operation, except that a 1-in. long bushing with a $\frac{1}{4}$-in. diameter hole is pressed into the $\frac{3}{8}$-in. hole in the arbor to provide for piloting the four-flute counterbore carried in the tilted turret of the tailstock slide. After the counterboring cut has been taken, the lever-operated turret slide is returned out of the way, and the cross and compound slides are manipulated to position the high-speed steel recessing tool bit for its cut. Stops on the two slides limit their travel when the correct depth of cut has been reached. A 100 percent inspection follows.

The small end of the Body II piece next is tapped, chamfered and threaded in the following Hardinge second-operation lathe set-up. The arbor employed is the same as for the previous operation, with a pilot bushing to guide all three tools. In order to speed up this operation, the six-station turret is equipped with two complete sets of tools and it need be indexed only from station to station to bring the next tool into position. First, the inside diameter is tapped with a solid four-flute 0.601″-24 Whitworth tap, next the hole is chamfered to remove the burr raised during the tapping operation, and finally, the outside diameter at the small end is threaded with a self-opening die head with chasers to cut the 0.744″-24 Whitworth thread. This is the only finishing operation on this part where a coolant is employed. A mixture of one part Tycol with five parts paraffin oil is flooded over the work.

Finally, the Body II pieces go to an inspection bench for a 100 percent check and then to a small speed lathe where the threads on the inside and outside diameters at the large end are burred, while the piece is held on a threaded arbor. Hand scrapers and emery cloth pads are employed. Then, before the parts are delivered to the degreaser and anodizing department, they are marked with the necessary identifying data in a rotary marking machine developed and built by the company.

Operations on Brass Stemmed Plugs

Brass stemmed plugs require two bench drill press operations and two bench lathe operations after they have been finished in the automatics. First, the center hole is reamed in a bench drill press using a high-speed steel reamer. This operation is not required on all of the pieces, being employed only when the drills in the automatic machines do not hold size within the limits required.

Next, the stemmed plugs go to a Reed bench drill press where two spanner wrench holes 0.100 in. in diameter are drilled at a center distance of 0.650 in.

Two spanner wrench holes are drilled in the brass stemmed plug in this set-up on a Reed bench drill. Spindle speed is 1,400 r.p.m. for the 0.995-in. drill

Lever operation of the cross-slide of this Hardinge lathe speeds the finish facing of the brass stemmed plug. For roughing, the tool is brought forward rapidly to the center hole in the piece — then, without moving the tool adjustment, the slide is returned slowly for finishing

in the face of the large end. These two holes are 0.07 in. deep. The drill jig for this operation is set in rails on a base plate which has stops at each end. The jig is brought against the stop at one end for drilling the first hole, then against the stop at the other end for drilling the second hole. Tolerances on all dimensions are ± 0.005 in. The quick-acting jig is lever operated, and a small air line directs a continuous blast of air into the jig to keep chips out of the working area.

These pieces next go to a Hardinge bench lathe where the large end is faced to a thickness of 0.290-0.295 in. A standard draw-in collet in the lathe spindle grips the small diameter of the piece for this operation, and the spindle is rotated at 3,000 r.p.m. The carbide-tipped tool bit employed has a $\frac{1}{4}$-in. nose radius and a 5-deg. back rake angle. The lever-operated cross-slide is brought forward quickly to bring the tool to the center of the piece for roughing, then is returned slowly for the finishing pass. It is essential that this surface be finished at right-angles to the axis, and that the surface be smooth. Therefore, an inspector is positioned at the other side of the bench, opposite the lathe, and each piece is checked in a comparator-type gage soon after it has been faced. A following bench-lathe operation is em-

Two 0.050-in. spanner key holes 0.460 in. apart are drilled 0.050 in. deep in the large end of the striker guide with this special high-speed head. During the operation the piece is held down in the loacting hole with a steel strap

ployed to finish-face the other end of this part. In this case, the part is gripped on the threaded large end in a collet chuck and the small end is faced with a four-blade piloted end mill which is fed in against a stop. The finished pieces then go through the degreaser and an acid dip before reaching the final inspection bench.

Two spanner key-holes are drilled at a center distance of 0.460 in. in the large end of the brass striker guide. For this operation, the two 0.050 in. drills are carried in a special two-spindle drill head driven by the spindle of an Allen sensitive bench drill press. The two holes are drilled to a depth of 0.050 in. The drilling head is of special interest because of the small center distance. It was designed and built by the company and, as shown in the accompanying photograph, has two guide pins fixed in the base. The spindles have spur gears on their upper ends, and these are driven by a larger internal gear which is supported by ball bearings. An air line is positioned to blow a stream of air across the base of the fixture, both to keep the fixture clear of chips, and to blow the piece into a box at the rear when the drilling operation has been completed.

Next, these pieces go to a Delta bench drill press where a 0.250 in. diameter counterbore is cut in the

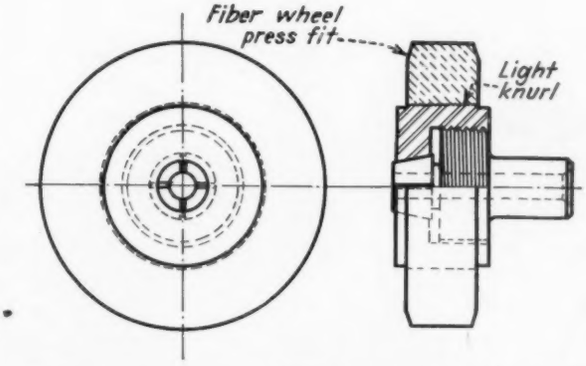
When rough and finish drilling detonator pellets the pieces are centered in the quick-acting jigs by bringing a tapered hole in the drill bushing down over the 0.265-in. small diameter of the part. Spindle speed is 3,000 r.p.m. for both operations

A Delta drill press drives the piloted 0.250-in. four-flute counterbore at 3,000 r.p.m. for one of the finishing operations on the brass striker guide

Each final assembly group is arranged so that the subassemblies feed from position to position around a U-shaped bench set-up. Girls at each position perform task operations for which they can be trained quickly

large end with a piloted four-flute cutter operating at 3,000 r.p.m. A quick-acting cam clamp holds the piece in a vertical position by gripping the 0.170 in. diameter stem. When the clamp is loosened, an air jet blows the piece out of position, so that the operator quickly can place the next piece in the clamp jaws. Further down the bench is a Delta bench drill press fitted with a jig which holds the stem of this striker guide in a horizontal position, so that a 0.065-in. diameter hole can be drilled at right angles to the axis of the piece. Two small balls are fitted into this cross hole during the assembly operation, and the location of the hole must be within a few thousandths if the fuze is to function properly. Next, the center hole of this guide is reamed to remove the burrs raised when drilling the cross hole. A flat two-diameter high-speed steel reamer is used in a standard bench drill press for this operation. Later, burrs are removed with hand tools from the various outside surfaces, and the guides are sent along to the degreaser and acid-dip cleaning stations for these operations.

Made both in No. OG Brown & Sharpe single-spindle automatics, and in $\frac{9}{16}$-in. Gridley six-spindle automatics from $\frac{3}{8}$-in. round aluminum rod, detonator pellets from the 40-mm. fuze are brought to a bench drill press group for finishing. This piece is a little



Detonator pellets are faced to length in Hardinge bench lathes while held in this type of collet chuck

less than $\frac{3}{8}$-in. diameter at its largest section, and is $\frac{3}{8}$-in. long. A 0.070-0.075 in. bottomed hole must be drilled along the axis from the small end to leave a metal thickness of 0.003-0.008 in. at the head. First, this hole is rough drilled in a one-spindle Allen bench drill press, using a 0.067in. drill and holding the piece in a quick-acting jig with the bushing in the top plate arranged both to locate the drill and to center the piece. A tapered hole is ground in the bottom of the bushing, so that it fits over the small

diameter of the piece when it is placed in a vertical position on the bottom plate. The next operation consists of finishing this hole with a 0.070-in. diameter drill having a 2-deg. lip angle. A Buffalo bench drill press is used for this operation, and the quick-acting jig has a bushing similar to that used for the preceding operation. For these operations, the drills are rotated at 3,000 r.p.m. Finally, the large end of the detonator pellet is faced to length in a Hardinge bench lathe, using a high-speed steel tool bit with a $\frac{1}{4}$-in. nose radius. Up to 0.005 in. stock is removed from the face of the piece during this operation. Next, the small end of the piece is burred with a piloted four-flute counterbore held in a Delta bench drill press.

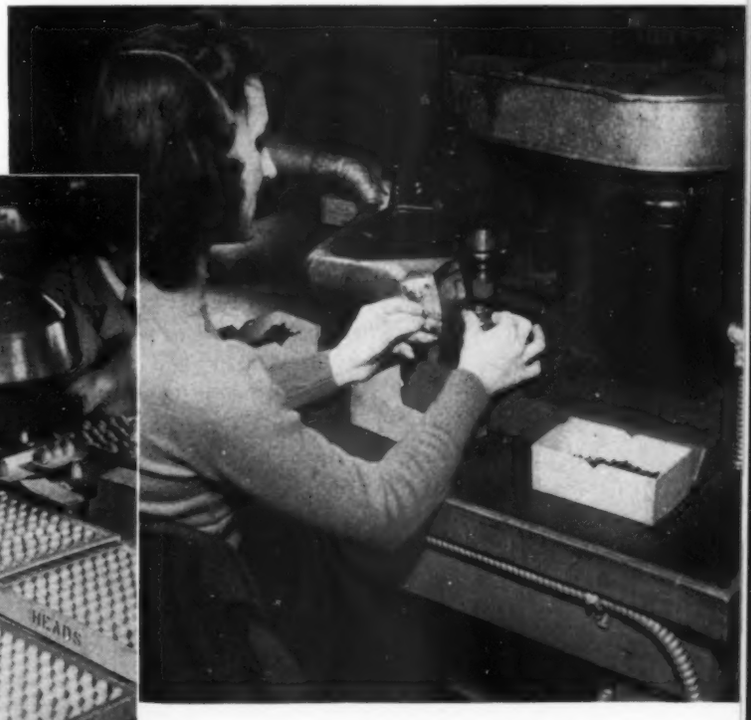
Task Jobs on Assembly Operations

The principle of breaking down operations into task jobs, followed throughout the machining department on parts for the 40-mm. fuze, is carried over into the assembly department. In all, 23 individual operations, including a number of government inspections, are required at the final assembly benches. A few of the minor subassemblies are put together at separate benches, then delivered in trays to the final assembly group.

In each final assembly group there are three parallel benches of relatively short lengths set at right angles to one long bench. The work of assembling the units that make up the Head and Body I subassembly are spaced along the L-shaped bench formed by one of the short benches and the long cross bench. The subassemblies move from position to position around the L and, when finished, are transferred to the outer short bench at the other end. Here they are met by the Body II subassembly which is completed on the short center bench. The final assembly is made by joining these two subassemblies, then inspection and packing operations complete the work on the finished fuze.

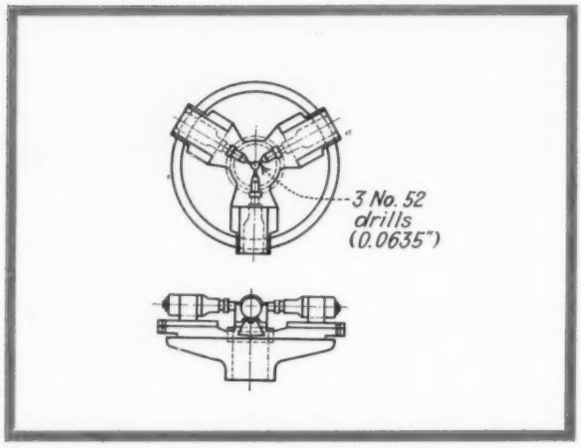
Throughout the subassembly and final assembly operations, particular care is taken to protect the various parts that make up the fuze. Any subassemblies that are dropped on the floor, for instance, are checked carefully as one of the small units may have been bent or broken. Every part delivered to the assembly benches has been checked 100 percent by the final shop inspectors and the government inspectors. Little trouble is experienced at the assembly benches with parts that do not fit. Immediately after assembly, the fuzes are packed in cartons, and sent to assigned loading plants.

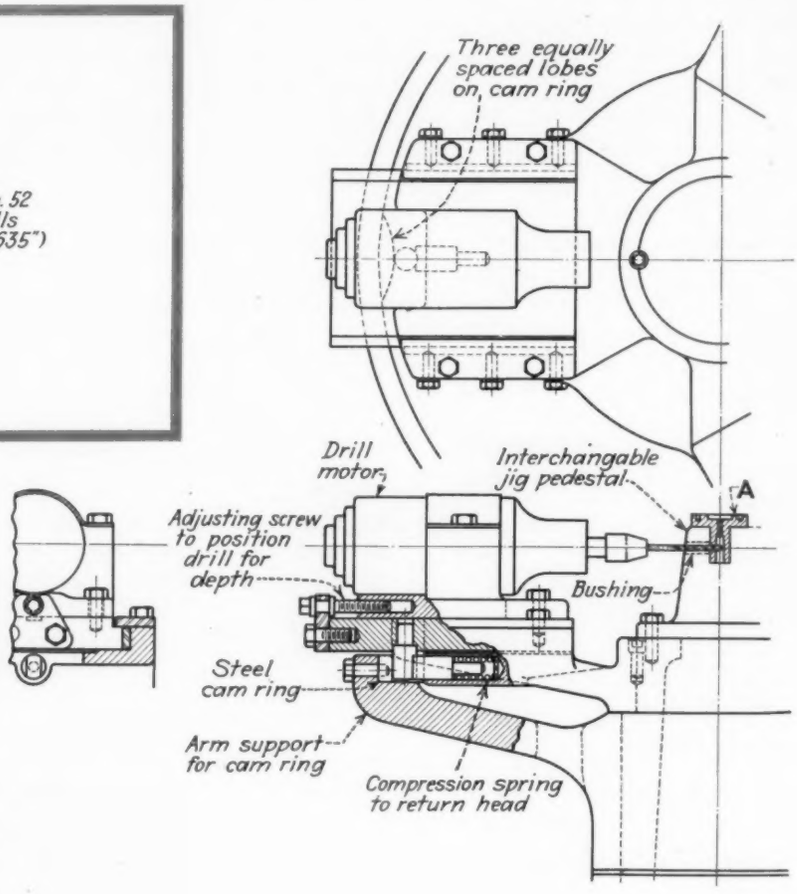
Hammer, head and Body I units are checked for selective assembly with this gage at one of the final assembly bench positions



Bakelite hammers are ground to length in specially-built bench machines in the assembly department. Finished pieces go direct to the final assembly bench

Three-Way Drill for Fuze Part





Three small motors spaced 120-deg. apart around this special drilling machine drive No. 52 drills for drilling the three ball holes in the striker guide for the 40-mm. percussion fuze. Feed is obtained by rotating the drill head assembly around the machine so that the three equally spaced cam lobes force the motor slides forward against compression springs

BRASS STRIKER GUIDES for the 40-mm. percussion fuze now being made in Canada formerly required three 0.065-in. diameter holes equally spaced at 120-deg. intervals around the stem, approximately 0.190 in. below the head. Special drilling equipment was difficult to obtain when the contract for this fuze was started, so the company decided to build a three-way sensitive drilling machine for these holes. Because of the small size of the part, the machine was made to mount on a work bench in line with other small machines used to finish this part. The fact that the striker guide now has two opposite holes which are drilled in a simple jig does not detract from the value of the design of this machine. It is described here because the principles involved may be applicable to similar operations in special units needed quickly for other ordnance items.

As will be noted from the drawing, the three drills were driven by individual motors having Jacobs chucks mounted directly on their spindles. Each motor was mounted on a slide which in turn was carried by one of three arms 120-deg. apart around a cast iron support. At the center of this support was bolted a removable jig pedestal which carried the three jig bushings and also centered the part in position for drilling. The motor support bracket was fitted on the top of a base pedestal, and was free to rotate around this pedestal when moved by hand.

The pedestal, in turn, was mounted in a larger casting having a number of arms which supported a large steel ring carrying three equally spaced cam lobes. Thus, when the motor bracket was rotated about the support pedestal by hand, pins under each motor base contacted the three lobes and moved the motors to bring the drills into contact with the work. A compression spring under each motor base maintained pressure against the other side of the pin, insuring that each base always was in contact with the cam ring. An adjusting screw on each motor base permitted moving the motor on its base to adjust for differences in the length of drills used in this three-way sensitive drill.

AMERICAN MACHINIST REFERENCE BOOK SHEET

Hand Hack Saw Blades

Courtesy Henry Disston & Sons, Inc.

How to obtain greater efficiency and make blades last longer.

FAILURE	CAUSE	CORRECTION
Pulling out at pin hole	Blade too tight.	Reduce tension. Allow just enough to hold blade straight and prevent twisting.
	Blade twisting in cut.	
Stripping teeth	Tooth spacing too coarse.	Use number of teeth recommended for material.
Blades breaking	Insufficient tension.	Make adjustment.
	Tooth spacing too coarse.	Use number of teeth recommended.
	New blade in unfinished cut.	Start new cut.
	Side strain on blade.	Do not bend frame sideways.
	Twisting blade.	Use firm, straight stroke.
Premature wear	Pressure on back stroke.	Lift slightly on back stroke.
	Insufficient pressure.	Cut slowly with pressure on forward stroke.

This material appears on the control cards used in the Disston Tool Conservation Plan.

RECOMMENDATIONS

No. Teeth Per Inch	Kind and type of material
14	For materials equivalent to one inch round or more — aluminum, brass, bronze, cast iron, copper, cold rolled steel, structural steel, rails, etc.
18	For materials ¼ to 1 inch in diameter. Also tool steels, drill rod, cold rolled steel and medium weight structural shapes.
24	For materials ⅛ to ¼ inch in thickness. Also pipe and tubing, BX cable, heavy sheet metal, moldings, etc.
32	For materials less than ⅛ inch in thickness. Also tubing, BX cable, sheet metal, moldings, etc.

It is suggested that blades of the flexible type be used where the operator is required to assume an awkward position, such as on a ladder. This situation often confronts electricians, plumbers and garage mechanics.

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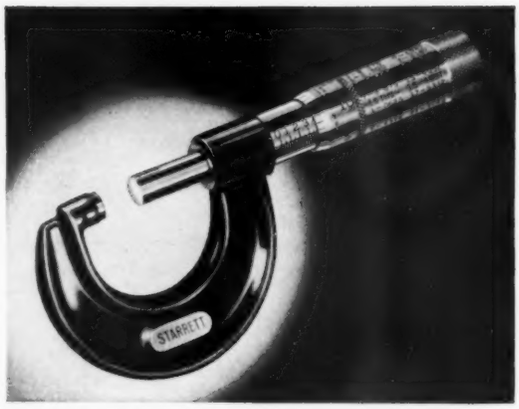
The STARRETT LINE is stripped for ACTION

For more than 60 years, The L. S. Starrett Co. has offered tool buyers and users an almost unlimited selection of precision measuring tools. Now, in order to make available a larger supply of the more essential tools, we have eliminated slow-moving items, odd sizes and minor variations that have formerly been available. This change in policy will in no way limit the quality, accuracy or *usefulness* of Starrett Tools. It *will* permit us to concentrate our efforts on the types and sizes of tools that are most widely used and which are most essential in war production work.



STARRETT MICROMETER No. 436

This model can be substituted readily for many similar models temporarily discontinued from the Starrett line. No. 436 is available in six sizes, 1 to 6 in. inclusive. Rigid yet light black enameled frame, quick reading graduations, decimal equivalents on thimble, popular priced.

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PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
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AMERICAN MACHINIST REFERENCE BOOK SHEET

Machinists' Files

Courtesy Henry Disston & Sons, Inc.

How to obtain greater efficiency and make files last longer.

FAILURE	CAUSE	CORRECTION
Stripping teeth	Choppy or fast filing stroke.	Use long, steady, uniform stroke.
	Too coarse a file for the job. Or using wrong file.	Use finer cut. Refer to recommendations on other side.
	Too much pressure.	A new file bites into the work more easily. File lightly at first.
	Work held improperly.	Work to be filed should be held tightly in vise.
Premature wear	Improper pattern, size or cut of file.	Refer to recommendations.
	Dragging file on return stroke.	Raise file slightly on return stroke.
	Filing too fast (or running work in lathe too fast).	Use long, steady, uniform stroke. Reduce speed so file does not slide or glaze.
	Too much pressure.	Ease up on filing stroke.
	File clogging.	Refer to recommended file and cut and use file card and brush.
	Rusty files.	Protect file when not in use.
	Careless handling.	Respect your file as a cutting tool and treat it accordingly.
Breakage	Cleaning file by knocking against vise or work.	Use file card and brush.
	Careless handling.	Do not drop or use as a lever for prying.
	Too much pressure.	On a new file apply light pressure. Ease up on filing stroke.
Clogging	Improper tooth and cut.	Refer to recommendations.
	Soft or tough gummy materials such as lead, aluminum, etc.	Draw the file back lightly along the metal on the return stroke so as to clean the teeth.
	Too much pressure.	A new file bites into the work more easily and clogs. File lightly at first.
	General clogging.	Use a file card and brush to remove chips which lodge in the teeth. By chalking cutting teeth, clogging can be avoided, and smoother work produced with less scoring and scratching.

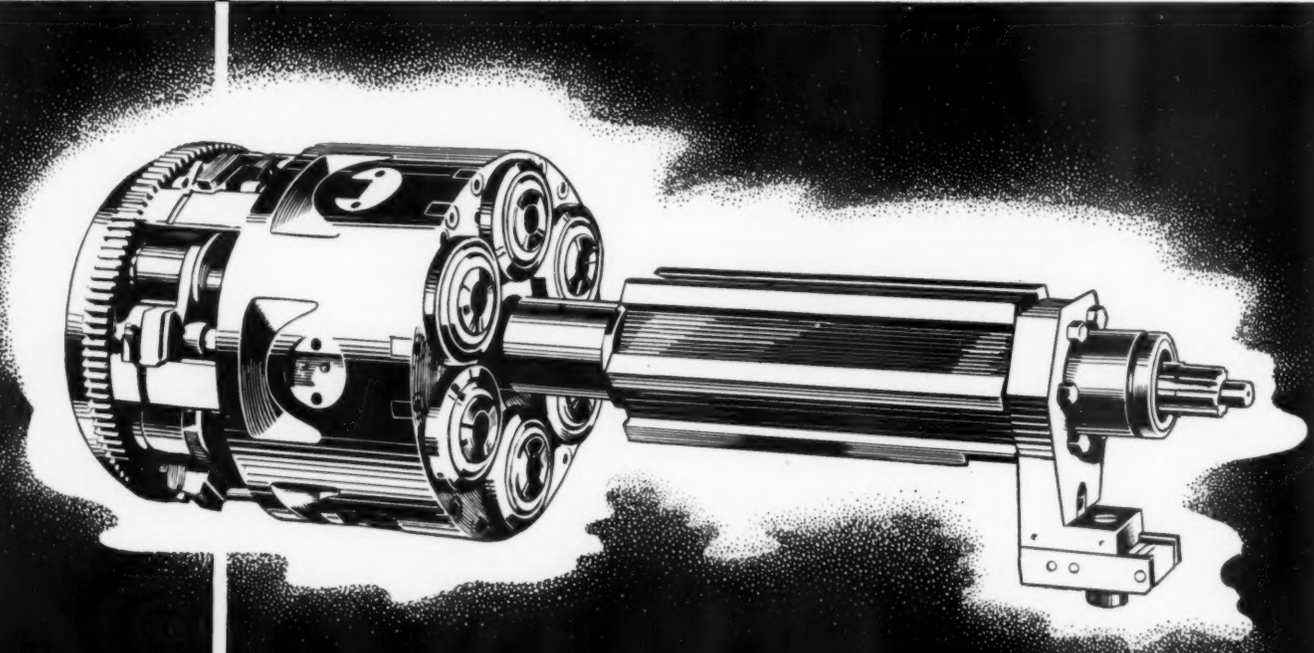
This material appears on the control cards used in the Disston Tool Conservation Plan.

GUIDE FOR THE SELECTION OF THE PROPER FILE FOR THE JOB*

1. Roughing where rapid removal of metal is the object, Bastard Files should be selected; however, where the work is of thin gage or light stock, choose a Second Cut or Smooth File with teeth of finer spacing, for filing across the thickness.	**Flat Surfaces** — Flat, Hand. **Holes** — Round, Square, Three Square, Half Round. **Corners** — Round, Square, Three Square, Half Round. **Slots** — Knife, Pillar, Warding.	**2. Finishing** where work is to be smoothed or finished, select Second Cut or Smooth Files. All thin and hard materials require Smooth Files.	**Flat Surfaces** — Flat, Hand Smooth. A Mill Bastard or Mill Second Cut is more desirable for a very smooth finish. **Lathe** — Mill, Flat. **Holes** — Round, Square, Three Square, Half Round. **Corners** — Round, Square, Three Square, Half Round. **Slots** — Knife, Pillar, Warding.

*Machine Shop Files are divided into three degrees of coarseness, depending upon the spacing of the teeth into Bastard as coarsest, Second Cut as medium coarse, and Smooth as finest. With the exception of the Mill, Mill-Lathe, and Shear Tooth Patterns, all the files in this group are double cut.

THIS is the spindle carrier assembly of a New Britain Automatic. It is permanently protected by the automatic lifting mechanism and is automatically clamped after index to eliminate all weaving during the cutting cycle • Exclusive New Britain features which prevent weave and wear, preserving initial accuracy under punishing service, have long been important to production executives. Today they mean more than ever . . . more guns, more ships, more planes, more tanks.



NEW BRITAIN AUTOMATICS

A complete line of chuckers — Four, Six and Eight Spindles to 10¼" Capacity.
Also a complete line of Multiple Spindle Screw Machines up to 2¼" Capacity.

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Psychic Income—War Asset

"PSYCHIC INCOME" sounds highbrow. In plain English it means the "lift" a person gets out of his work, aside from what's in the pay envelope.

In wartime, psychic income takes on a new and more important meaning. If it is high, it can spell greatly increased production of war goods vital to victory.

Creation of a high psychic income no the part of millions of industrial workers is essential to the war effort. Why? Because so many workers are removed thousands of miles from the battle front and it may be difficult for them to get steamed up about their individual contribution to licking the enemy.

Take Bill Smith. He runs a lathe in a machine tool plant, or perhaps he operates a machine in an aircraft parts factory. He seldom if ever sees a finished tank or plane or other weapon or has any contact with the men of the armed services. The closest he ever comes to actual warfare is reading about it in the papers.

The Army and Navy are trying to do something to make millions of Bill Smiths conscious of their part in the war. Army officers are visiting war plants, bringing the man in the aircraft shop, for example, into contact with the crew flying one of Uncle Sam's flying fighters produced by that shop. The Navy is awarding "E" pennants and buttons to firms which have done outstanding jobs in the production of war equipment.

But such programs must be supplemented by the efforts of the managements of the thousands of plants doing war work.

Immediately after Pearl Harbor war production rose without the addition of a man or a machine. Workers were fighting mad and did a real job. That aggressive spirit has been retained at fever heat in too few plants. Many things can be done to rekindle it where it has died down.

North American Aviation affords one example. It broadcasts United Press news about the war over a public address system during the lunch hour, plus music selected by employees. During working hours it announces special war bulletins as they come in over the news ticker. Many of these bulletins are about operations in which aircraft have taken part. Sinkings of Japanese cruisers and submarines by U. S. airplanes have been broadcast with excellent effect on the morale of the men.

The British have found that tank factory employees, for instance, have redoubled their efforts after witnessing movies of their own tanks in action in the Middle East. Every shop man then feels that he has a first-hand part in winning the war.

Plenty of cases of effective campaigns to bolster workers' morale can be cited. The Radio Corporation's "Beat The Promise" campaign is one. But a few hundred factories conducting organized campaigns is not enough. Thousands should be doing it.

Such programs may smack of propaganda and be labeled "rah-rah" stuff, but they contribute mightily to drawing the second-line army of munitions workers closer to the front-line army of combat troops.

During these war days we should supplement the actual dollars in the workers' pay envelope with just as much psychic income as possible. The higher the psychic income, the greater the unity in this country and the quicker we shall gain preponderance over our enemies.

Burnham Finney

GAGING BUSINESS

Material shortages reduce output. Machine tool industry benefits from three-shift operations; production rises. Tighter steel controls impend. Production crosses hump

Shortage of materials is the most important handicap to war production in the metal-working field. Some makers of critical war implements say that they could turn out a considerably larger volume if they could secure the necessary materials. In fact, certain manufacturers have had to reduce their work-week because they did not have enough material to work longer hours. Despite this handicap the output of war goods by metal-working companies is mounting at a rapid rate, with many firms far ahead of projected schedules.

Machine Tools—The beneficial effects of three-shift operations and of new plant additions going to work for the first time were felt in machine tool production for March. The total for machine tools alone rose to $98,000,000, a gain of $13,000,000 over February. The increase in dollar volume from February to March was appreciably more than the total monthly output in a prewar month. If presses and other machinery which does not cut metal were added, the March figure rose to $109,000,000. It is a safe guess that April showed improvement over March.

The machine tool industry believes that the new allocation order E-1-b will operate far more satisfactorily than the now-abandoned stamp plan. The new system, which replaces the priorities scheme in force for the last year, is half way between the plan heretofore prevailing and the complications of the stamp plan. It is essentially a move to allot machine tools more equitably among the contractors of the armed services. It involves a reshuffling of orders now on the books of machine tool companies, a tremendous task in itself.

Soviet Russia is seeking large quantities of critical machine tools from American builders. It is having trouble placing orders for delivery within the time specified. Its purchases already run into tens of millions of dollars. In some cases it has been able to get deliveries before the end of this year. Washington still is pledged to furnish an important number of machine tools to Russia every month.

Recent purchases of machine tools by domestic war contractors have been heavy. Nevertheless many people in the industry and some Washington officials believe that the time is near when machine tools will be produced in sufficient quantities to machine all available war materials. What bothers the industry is the huge number of machine tools either idle a good part of the day or tooled up inadequately for the war job to be done. In other words, builders think that the best use is not being made of available machine tools.

Steel—Still tighter controls over the use of steel will be exerted. Almost all non-war consumers have been barred from getting any further tonnage until after the war. The pressure for certain alloy steels is so great that high priorities do not insure a buyer deliveries within a reasonable time. The worst situation probably is in plates for ship construction. The big bottleneck in the war program is in ships. Everything possible is being done to better this situation, including the increasing of plate-rolling capacity. Wide strip mills, for instance, have been asked to turn out all the plates possible. Sheet mills, incidentally, are finding that a surprisingly large percentage of their tonnage is going directly into war operations. Essential construction work for the war program will take a large tonnage of heavy steel this year. A record performance in bringing down ore from the Upper Lakes is expected, though to accomplish this feat it will be necessary to divert coal and grain from lake boats to rail transportation.

Railroad Equipment—Builders are at work on locomotives and cars approved by Washington for construction during 1942, though the number is far below the normal capacity of the plants in this industry. Much of the capacity has been diverted to war work or cannot be used because materials for fabricating locomotives and cars are not available.

Shipbuilding—Construction of cargo ships is now at a rate better than one a day and shortly will be two a day. Before the end of the year it will be three a day and perhaps four. As inland shipping is diverted to intercoastal waterways, an increasing number of wooden towboats and wooden barges will be built to handle inland water transportation. They will require a negligible amount of steel and of other scarce materials. Old-fashioned simple steam engines likely will provide the propulsion machinery. They can be made in the smaller shops along and near the rivers. The Sea Otter project is up again. The Sea Otter was to be a 300-ft. cargo ship, designed by the Navy and powered with multiple automobile engines, to ply coastwise and in shallow harbors. The original idea of a propeller located amidship and driven by a vertical shaft down through the bottom in the manner of an outboard motor installation didn't work. Now a new manufacturer has taken over the development work. Reports are that gasoline automobile engines will be used only for dry cargoes and diesels for oil and other inflammables.

Munitions—When Donald Nelson said that America was over the main war production hump, he was not exaggerating. Output of the United Nations is now in excess of that of the Axis powers plus Japan. In one of the major war production items, the volume is approaching twice that anticipated for May and June. Most of the string of some 70 ordnance manufacturing plants distributed around the country have been completed and are in at least partial operation. The majority were completed well ahead of schedule.

Aircraft Engines—A development that may result in superior performance of American planes has been made by the Wright Aeronautical Corporation. They have perfected a method for mass production of forged cylinder heads for aircraft engines. The result of five years of development work, the new method will be available to all engine manufacturers. The forged cylinder heads weigh about 3½ pounds less than the old cast ones, have 35 percent more cooling area and 100 percent more physical strength. The forged heads will permit prolonged operation of engines at rated horsepower ratings at low altitudes thus making it of value for tropical operation. Cooling is improved by an increase in the conductivity of the metal. Greater power output at higher altitudes will be available. Decreased fuel consumption will result from enlarged intake and exhaust posts made possible by the new method. A finer and more uniform grain structure is possible in the forgings, making possible higher compression ratios and increased power output without additional weight. Details of the process have not been revealed, but it is known that aluminum bar stock is forced through a die, emerging roughly in the shape of the desired unit. It is pressed into another die, where it takes its final shape. Nine drop-hammer operations are eliminated.

Small Business—A warning that small businessmen will have to go out of business unless they can produce material necessary to the war program was issued by W. O. Crabtree, New York State district manager of the Contract Distribution Division of WPB. Referring to the recent order banning the use of iron and steel in more than 400 items he said that it would stop business from doing anything that is not in the war program. "It is not a question of what businesses we can save," Mr. Crabtree said, "it is a question of winning the war."

Priorities Revoked; Machine Tools Allocated

Order E-1-b allocates all new machine tools; gages, used machines not affected; order will require careful study

WASHINGTON—Effective May 1, after 16 months of control under priority orders and amendments of the Defense Commission, OPM, SPAB, and WPB, production of the machine tool industry is allocated 75 percent to the fighting services and the Maritime Commission, and 25 percent to foreign customers and essential domestic industries, meaning the machine tool industry itself.

Because machine tools are the keystone of war production, their distribution has been a hard problem from the beginning. WPB has been trying to develop an allocation order since late last year. The new order covers only tools that are critical to the war effort. Some types of machine tools are still plentiful.

No man could say for sure that the new Order E-1-b is not the best possible in the circumstances, but all can see that it is complicated by lawyers' patios, and will require much study. The order's best recommendation is that responsible spokesmen for the industry say they believe it is workable.

The old General Preference Order E-1-a is revoked, and so is the old Numerical Master Preference List Revision No. 1, except with reference to present schedules and present "urgency standings."

Makers of gages and chucks will continue to schedule their production according to the old Order E-1-a, revised, until further orders from WPB's Director of Industry Operations.

Used machine tools remain under the old preference ratings and are not affected by this new allocation order.

Machine tools are defined by the order as products listed as Group I and Group II in "Exhibit A." This document is restricted, but tool manufacturers will have received it by now. Machine tools are called "tools." A machine tool unit includes not only the basic tool, but all the fixtures, equipment and tooling ordered with it. But it does not include any replacements or repair parts.

Monthly Schedules

Each producer under the order schedules his production for each month so as to deliver 75 percent of his output of each size of each type of tool which he produces that month to service (Army and Navy and Maritime Commission) purchasers. And each producer schedules 25 percent in the same manner, to foreign and other purchasers.

Two exceptions: a producer may schedule to service buyers more than 75 percent of his output of any size of a type of tool in any month, to the extent that he has failed to receive orders for foreign purchases and rated orders from other purchasers for tools of such size and type, prior to the first day of the fourth month preceding the month of delivery. Likewise, a producer may schedule more than 25 percent to foreign and others to the extent he has not received service orders, prior to the first day of the fourth month preceding the month of delivery.

In preparing his schedules, the machine tool builder is to fix his dates of delivery to service, foreign, and others so that each class receives its percentage equitably in point of time within the month.

Then the order sets forth the distribution of the 75 percent among the service purchasers. These service purchasers are divided into six groups: Navy Bureau of Ships; Navy Bureau of Ordnance; Army Ordnance Department; the Air services (Army Air Forces and Navy Bureau of Aeronautics); miscellaneous bureaus and branches; and the Maritime Commission. Miscellaneous bureaus and branches means Army Quartermaster, Corps of Engineers, Medical Corps, Chemical Warfare Service, and the Navy Bureau of Yards and Docks and the Marine Corps.

Exhibit "A" specifies a percentage of each type of tool to be delivered to each of the six service purchasers, the aggregate being 75 percent. The stated percentages are the producers' quotas of any type and size of tool for that month, to be delivered to the service purchasers.

If at the beginning of the fourth month preceding the month of delivery, the producer does not have on hand rated purchase orders from any of the

What the Machine Tool Builder Does Under Order E-1-B

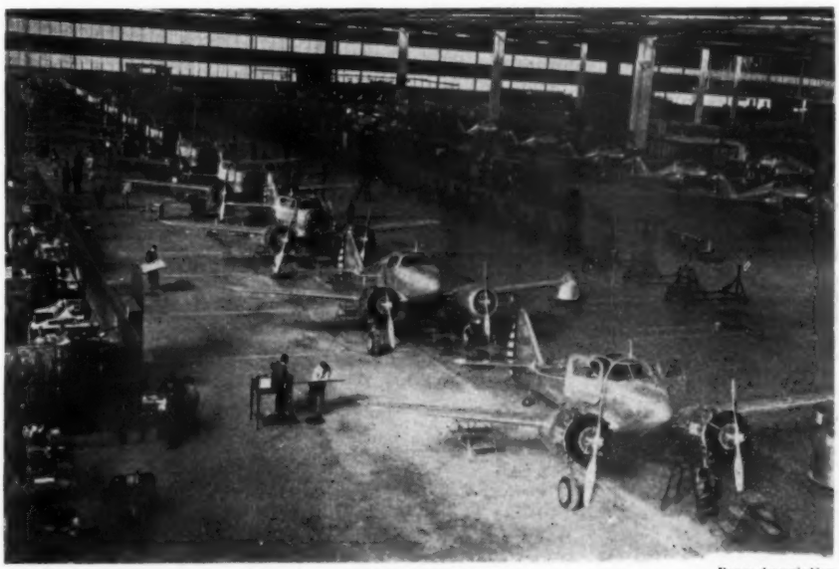
1: First comes the freeze period, during which current orders remain undisturbed. This period ends for Group I tools on June 1, and for Group II on July 1.

2: Beginning now, during the freeze period, until June 1, the builder rearranges all of his Group I orders for June, July, and August in accordance with the percentages of his types and sizes of tools assigned to the classes and groups of purchasers.

3: Then on the first of June he rearranges his schedule of orders for September; on the first of July he rearranges his schedule for October, and so on.

4: Beginning now, during the freeze period, until July 1, he rearranges all of his Group II orders for July, August, and September, as above.

5: Then on the first of July he rearranges his schedule for October, and so on.



Press Association

Advance Trainers on Assembly Line—Trim, twin-engined Curtiss At-9 advanced trainers roll off this long assembly line in a new aircraft factory that is located "somewhere inland". This type of plane was designed to help pilots in training to transfer from primary trainers to high-speed multi-engine bombers

Acme

Rolling Machine Shop—Army guns in action need constant attention and repair. Rather than ship them to central repair stations repairs can be made in former railway maintenance cars like this one. Each generates its own power and is equipped with a variety of machine tools, small tools and welding apparatus

six groups, equal to the group's quota, he is to schedule orders received from members of other service groups for that size and type, for delivery during that month. If two or more service groups have placed orders more than aggregating this unordered balance of the first group's quota, the producer will schedule such orders in accordance with the urgency standings of respective purchasers. All orders are to be studied and then scheduled equitably in point of time.

Preference Ratings

In the distribution of the remaining 25 percent of machine tool production, foreign purchasers and other purchasers are lumped together. That is, the machine tool builder is to schedule 25 percent of each size and type of his output for foreign and other purchasers; in accordance with a sequence of deliveries specified in the order. Provided however, that if orders from these two classes total up more than 25 percent of the sizes and types in a given month, all the details about the overplus orders are to be reported to the War Production Board. The Director of Industry Operations will then tell which ones are to be eliminated.

The new allocation system is still hooked up with the preference rating system. This is how: excepting foreign orders, no orders received after May 1 are to be scheduled unless a rating of A-10 or higher has been assigned to them on one of the P certificates. The certificate itself need not be delivered, but each order must bear a proper endorsement. This endorsement, or a separate endorsement, must include the urgency standing of the purchaser—which means his relative position on the Numerical Master Preference List, Revision Number 3; required delivery date; in the case of service purchasers, number of the prime contract, and name of the contractor; in the case of foreign purchaser, the country for which tool is purchased; in the case of other purchasers, a statement as to the product or program for which the tool is to be used.

Where a preference rating has been filed before May 1, or where it does not show all this detailed information (and if the producer does not have it), he is to require a written certification.

Foreign Purchasers

For the purposes of this allocation order E-1-b, all foreign purchasers are assigned a rating of A-1-a. The Numerical Master Preference List—called "The List" for short—determines the sequence of deliveries as between service purchasers, but it has no effect upon foreign and other purchasers.

The sequences of deliveries of tools among each group of service purchasers and among foreign and other purchasers is determined by required delivery dates, by preference ratings and by the urgency standings contained in the list. These alternatives are detailed under paragraph 2, Section I, of the order.

When a producer cannot schedule delivery of a tool, because the quota of the purchaser's group is exhausted, he simply schedules it in the earliest month when the group's quota has room for it.

When Unfreezing Comes

Of course the DIO can change the order of, or add to, the Numerical Master Preference List. A new name is dubbed in with a decimal; for example 792.1 would come between 792 and 793.

When unfreezing times come—June 1 for Group I and July 1 for Group II, each producer will revise his delivery schedule in accordance with percentage allocations and quotas of the classes and groups of purchasers. But only in so far as he can do so without delaying the delivery of special tools already in course of construction. Unless the DIO so directs, no higher preference rating or urgency standing shall be allowed to delay production of Group I tools to be delivered in 30 days, and Group II tools scheduled to be delivered in 60 days. No one but the DIO or his representative can give directions respecting sequences of deliveries.

What the Machine Tool User Does

1: He continues to send in his orders, with proper priority certification and urgency standing, just as he always did.

2: If his delivery schedule is too slow to meet his need, he can appeal to his contracting officer for a remedy. The contracting officer is his best contact, because the officer personally knows the tool user's problems.

3: The tool user can appeal to the War Production Board for a higher position on the Numerical List (although this is not encouraged); he can appeal for a higher preference rating; or, in emergency, he can appeal for a change in the sequence of the builder's deliveries. Both builders and users should address all reports and communications to the War Production Board, Washington, D. C., Reference E-1-b.

Packaging Company Assists Firms With Low Priorities

SPRINGFIELD — Manufacturers of package goods who cannot obtain new wrapping machines because of the recent freezing order are being assisted by the Package Machinery Company. This Massachusetts firm is assisting them to get in touch with other producers who have idle machines which they are willing to sell. Slight alterations will frequently adapt a machine to the new requirements.

The Package Machinery Company states that they will neither buy nor sell these machines. Their aim is to assist companies who cannot obtain sufficiently high priorities to insure delivery of new machines, thus advancing the interests of the industry.

INSIDE DETROIT

More extensive heat-treating will result from substitution; parts specifications rewritten. Reversion to last October prices will be ruinous to some sub-contractors

BY RUPERT LEGRAND, DETROIT EDITOR

DETROIT—Manufacturers of armament material, especially sub-contractors, must be prepared to cope with more extensive heat-treating and higher production costs, as a result of the broad-gage materials substitution program now underway under the auspices of automotive metallurgists and engineers.

To save chrome, nickel and manganese, parts specifications are being rewritten extensively. In some instances, heat-treated carbon steels will be used instead of alloy steels in the "as rolled" or "as forged" condition. High-alloy steels requiring localized carburizing are giving way to low molybdenum steels. To save manganese, SAE 1025 has been substituted for X 1020 used in the as rolled condition.

The National Emergency steels are still undergoing industrial research on a broad front to correlate information on hardenability and tensile strength. Data are being assembled under the chairmanship of John Mitchell, manager of the alloy bureau, Carnegie-Illinois Steel Corporation, Pittsburgh, and will be made available to armament manufacturers in the form of booklets which will be distributed privately by WPB.

Already marked savings of critical metals and rubber have been made under the materials-substitution program. Examples follow:

To Save Nickel

On a certain military vehicle, SAE 4620 has given way to 4027 or 4032, thereby saving twenty tons of nickel on one purchase order alone, and with much greater savings to be achieved as more parts go into production. These molybdenum analyses have also been applied to parts formerly requiring nickel-molybdenum and nickel-chromium-molybdenum steels, such as SAE 2315, 4320 and 4620.

In aviation engines all 5 percent nickel steels, have been eliminated from cams and accessory drive shafts.

To Save Chromium

Plain carbon steel has been substituted for chromium steel in valve tips. Nickel-moly carburizing stock is now specified for ball and roller bearing retainers, push-rod ball ends and other aircraft engine parts not requiring high core hardness.

By engineering military vehicle parts out of the nickel-chrome steels and into straight carbon or carbon-moly steels, approximately 200 tons of nickel and 130 tons of chromium were saved on one recent purchase order for 12,000 tons of steel.

To Save Tin

A 1 percent silver, 99 percent lead solder has been found suitable for soldering copper, brass and steel, although higher soldering temperature is required.

Connecting-rod bearings have been engineered progressively from babbitt lined with metal thickness of 0.30 in., to steel-backed liners with 0.010 in. babbitt thickness and later 0.005 in. lining thickness, and finally to a lead-base babbitt with only 1 percent tin content.

To Save Rubber

For certain truck parts where the highest resiliency is not required, over 50 rubber items have been changed to felt, plain or treated fabric, plastics, reclaimed rubber, saving approximately 95 percent of the first-class rubber material formerly specified. Molded gilsonite is being tried for battery boxes. Volute springs are suggested for rubber motor mounts. Wood or plastic will be used in steering wheels. Impregnated fabric will take the place of rubber torque-tube bushings in military trucks.

Price Control

Auto-parts companies, especially those making material under sub-contract for civilian or munitions purposes, are searching for the answers under Order 136, which sets prices back to Oct. 1. Sub-contractors are hit particularly for a variety of reasons. In most cases, material costs have risen since the base period, especially upon scarce materials, labor costs have risen too. If the sub-contractor has expanded production facilties greatly, and set close-margin prices in the hope of making a fair profit on volume production, it is likely that reversion to October 1 price standards will be ruinous. In other cases, firms follow the practice of making price adjustments to customers at some such periods as April and December. Reversion to the October base pushes such operators back two-thirds of the way to price schedules obtaining a year ago, regardless of increases in labor and materials since. And there is the man who may have gone into production of say a military-vehicle universal joint with a contract specifying that the price will be set upon actual cost experience. Will he be asked to stick to preliminary estimates reached last fall?

Sizing Up the War Job—Stimulus to Packard workers is this graphic way of portraying the war production job just done, and projecting the increased goal ahead. Scoreboard posters like this, placed in strategic plant locations, are part of Packard's new "Work to Win" Program

Experts Agree Segregation Most Important Factor in Successful Scrap Salvage Program

NEW YORK—A great deal of waste results from failure to keep different types of scrap separate at their source. The importance of segregation was repeatedly emphasized in a symposium on the engineering aspects of the industrial scrap salvage program held here April 28.

Emphasizing the importance of the scrap salvage program, Paul C. Cabot, deputy chief, Bureau of Industrial Conservation, said that at the present time nine furnaces are closed down because of a lack of scrap iron and steel. A warning against trying to use light turnings without first briquetting them was voiced by Dr. Charles Herty of the Bethlehem Steel Company. The difficulty of charging light turnings into a furnace will reduce the total output of the furnace.

A thousand pounds of new nickel can be used to make 12.8 tons of nickel steel ingots, if no scrap is used. If only scrap originating in the steel mill is used, this production can be increased to 16.9 tons. If to this is added scrap produced in the process of fabricating finished products from the steel ingots, the production from a thousand pounds of new nickel is raised to 22.8 tons.

Reclaiming Grindings

An important source of scrap is the grindings produced in many manufacturing operations. Four methods are used to separate grindings from abrasive particles so that the metal can be reclaimed. These methods take advantage of differences in specific gravity, in magnetic attraction, in electrical conductivity, and in surface tension. Just as in handling all kinds of scrap it is important to keep different types of grindings segregated.

Robinson D. Bullard, Reclamation engineer for the Bullard Company told the conference that his firm is saving 25,000 gallons of cutting and lubricating oils a year, 125,000 pounds of cotton and wool waste, and that its briquetting

ROBINSON BULLARD

plant is handling 15 million pounds of iron borings and steel turnings for remelting.

Through careful handling and routing of borings and turnings, the Bullard Company recovers some 35,000 pounds of chromium and 75,000 pounds of nickel a year, materially reducing the firm's demands for virgin metals.

Reclaimed rubber has in the past come largely from old automobile tires. Because of the natural reluctance to part with tires today, this source has been almost completely eliminated; other sources of reclaimed rubber must be developed.

Many large plants have found that the difference between profit and loss lies in their salvage programs. It was reported that one firm has an average cost in operating the salvage department of 10 cents on the dollar of salvaged material sold.

Salvage can no longer be considered purely from the cost standpoint, however, and all scrap must be salvaged at whatever cost when there are shortages of the material in question. The Bureau of Industrial Salvage has a ladder of critical materials ranging from aluminum, as most critical, down to wood, as least critical. Emphasis is given to the importance of salvage by the fact that steel, which is just above wood in the ladder, is now facing shortages.

WAR ORDERS IN BRIEF

ALUMINUM SCRAP—The maker of segregated scrap must hereafter furnish buyer with a signed statement showing specifications, form, weight, name and address of plant where the scrap is generated. Date of sale and names and addresses of the transacting parties must be shown also and any further resale must be similarly indorsed. (Amendment 1 to Supplementary Order M-1-d).

DEFENSE ORDERS — Government orders from Czechoslovakia, Free France, Iceland and Turkey have been assigned a preference rating of A-10 if no higher rating has been given by certificate or otherwise. (Amendment 2, Priorities Regulation 1)

FLUORESCENT LIGHTS—Effective immediately manufacture without restriction is permitted of fixtures with a lamp capacity of 30 watts or less if materials were ordered on or before April 2 and actually on hand by April 20. Small fluorescent fixtures may be manufactured if materials to be incorporated into them are acquired under an A-2 preference rating or under any assigned under the Production Requirements Plan. Unrestricted sale of small fixtures and of cold cathode (high voltage) fluorescent lighting fixtures is allowed. (Amendment No. 1, Limitation Order No. L-78).

FREIGHT CARS — All preference ratings of A-2 or lower on raw materials for freight car construction have been cancelled except on material already received by or placed in transit to the producers. At the same time the order permits any producer to sell and deliver any material on hand or in transit to any other producer of freight cars. (Supplementary Limitation Order L-97-a-1). Mining locomotives, however, are excluded from the foregoing provisions. (Amendment 1, Limitation Order L-97).

LAMPS—Extension to May 31, 1942 has been granted to permit manufacturers and suppliers to use up fabricated and semifabricated parts. Manufacturer may not produce during May more lamps or shades than 50 per cent of his total quota for May and June. (Amendment 1, Limitation Order L-33).

LEAD—May lead pool has been set at 15 per cent of March, 1942 production. This is unchanged from previous months. (Supplementary Order M-38-h).

METAL WINDOWS — Manufacture of metal windows, composed wholly of materials in a manufacturer's inventory prior to March 25 for use in a project to which a preference rating has been assigned by Orders P-55, P-19-d and P-110, has been authorized. After May 1 deliveries of material for manufacture of metal windows cannot be made except under Production Requirements Plan. (Amendment 1, Limitation Order L-77).

MINING MACHINERY—Mine operators may obtain repair parts for explosives and explosive equipment. (Amendment to Preference Rating Order P-56).

SEWING MACHINES — A limited number of sewing machines and attachments may be produced between now and June 15, 1942, after which production must cease. (Limitation Order L-98).

STORAGE BATTERIES—To conserve certain critical materials production of storage batteries has been prohibited after April 30 except in specified minimum ampere hour capacities. (Supplementary Limitation Order L-4-b).

TIRES—Heavy trucks produced under existing quotas may be equipped with tires and tubes. (Amendment 7, Limitation Order L-1-a).

Canadian Explosives Output Exceeds World War I Total

OTTAWA—Production of explosives in Canada during a six months period is now double the country's entire production in the first World War, according to the Department of Munitions and Supply. This production comes from about thirty plants which cost $125 million and employ 45,000 people. One third of the employees are women.

OPA Abandons Single Controls on Prices; Adopts Sweeping Price Fixing Regulation

BY ROBERT COLBORN

WASHINGTON—The prices charged by manufacturers for substantially all goods and services not already covered by official price ceilings are not permitted to exceed March levels under the General Maximum Price Regulation issued late last month by the Office of Price Administration. On May 18 retail sales of goods become subject to the same price freeze, and on July 1 sales of services at retail.

Each manufacturer has a personal price ceiling for each item he sells—the highest price he obtained on any March delivery of that item. If he made no deliveries in March, his ceiling is the highest price he quoted in March. If he is unable to price an item by either of these tests, he must set a price and submit it to OPA for approval.

With this order OPA has abandoned the long effort to control prices one at a time and is attempting to freeze the entire economic structure, with the important exception of farm prices (though most processed foods are covered) and wages, which the President is attempting to control through semi-voluntary stabilization.

The great majority of metal-working manufacturers are already covered by some one or another of OPA's price ceilings. In such cases the individual price ceiling controls. Of particular importance in this connection is the broad machinery price order (Regulation 136) issued a few days after the general price freeze. Not only does this regulation take the place of the general freeze for the items it covers, but it also supersedes all the informal agreements and "freeze letters" issued on machinery. It does not, however, affect last January's machine tool price freeze, Schedule 67.

Covered by the machinery order are nearly all other types of machinery, including: prime movers, industrial power apparatus, material working and fabricating machinery, construction and mining machinery, electrical and railroad equipment, auxiliary industrial machinery, related equipment, and parts of these types of machines.

Used Machines Covered

Used and rebuilt machines are covered, as is rental of machinery. The regulation also establishes ceilings on "machine work"—work done by machines for cutting, abrading, shaping, forming, or joining on material furnished by the customer.

Reason for issuance of this machinery order is that the general freeze order is drafted primarily to cover transactions in standard goods, things which are the same today that they were last March. It is recognized that machinery manufacturers work largely on special design jobs and that if they were covered by the general price regulation they would have to submit thousands of individual prices to OPA for approval.

In general, the machinery order holds prices to the levels of last October although this makes it somewhat more severe than the general freeze which takes March as the base. OPA, however, contends that in the machinery industries March prices were the same as October prices except for a few sellers who failed to conform to OPA requests to keep prices in line.

The maximum manufacturer's price under the order for any new machine or part is the established price on Oct 1, 1941 if there was such a price on that date. If there was no established price in October for the machine in question, the ceiling price shall be computed by using the labor rates, material prices, and overhead rates in effect Oct. 1 and the price-determining method which would have been used on that date. This price shall be filed with OPA and becomes the established price if not disapproved within thirty days. Where this computation cannot be made because materials are being used for which there is no October price or because it is being made in a new plant a price is to be computed as nearly in line with October rates as possible and submitted to OPA for approval.

Ceiling price for a machine or part sold by a distributor is his October price, if he has one, and otherwise it is the net cost to him of the machine plus the percentage markup which he realized on the most nearly comparable sale on or about Oct. 1. If there was no equivalent sale, he shall submit a price to OPA for approval.

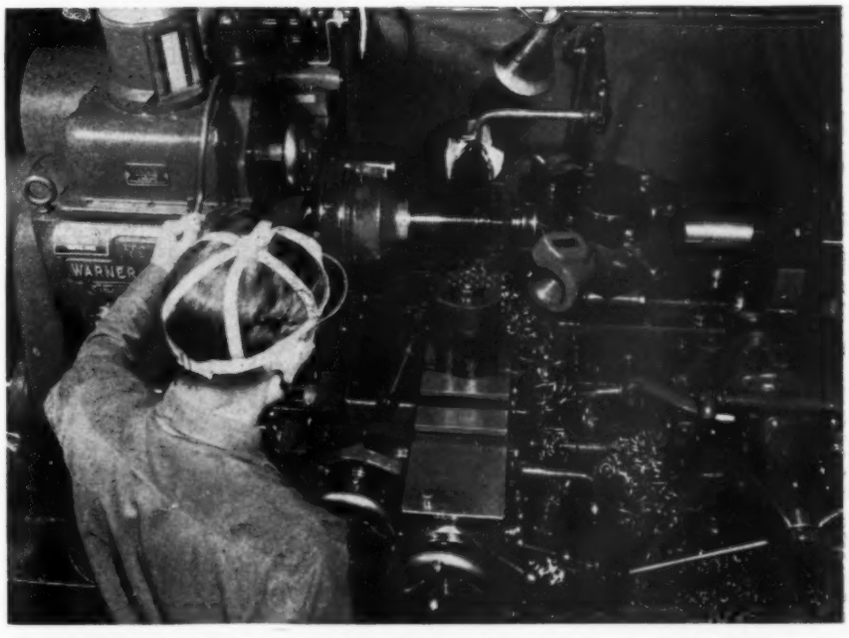
Ceiling on rebuilt machines is 85 percent and on other used machines 55 percent of the Oct. 1 price of the most nearly comparable new machine.

Rentals on machinery are limited to the rental in effect Oct. 1, the rental which would have been in effect then, or to a rental approved by OPA.

Ceiling charge for machine work is the Oct. 1 price, if there is one, or a charge computed on the basis of labor and machine-hour rates in effect on that date.

An important exception is made for machine work or manufacturing on which there is no established Oct. 1 price and which is done on order as part of a subcontract—i.e. where the goods produced will be incorporated by the buyer into his own product. Such transactions are exempt both from the machinery regulation and from the general price freeze. There is no control over the price that may be charged. Theory behind this exemption is that subcontracting is increasing rapidly and that price practices have not yet jelled. It would therefore be unfair and unwise to try to freeze them.

Manufacturers whose products are not covered by the machinery order or other specific OPA regulations, and whose prices are therefore frozen at March levels by the General Regulation, should be prepared to have their prices pushed farther down.



Multiple Cutters Save Hours—Many hours of man- and machine-time are saved by the use of multiple-cutters of tungsten carbide recently set up on this job at the Seattle plant of the Boeing Aircraft Company. The part is an exhaust stack boiler of stainless steel for the four-engine Flying Fortresses

Five-Man Shop Tackles Precision Work, Develops Into Important Sub-Contractor

BY A. W. JESSUP

A NEW ENGLAND CITY—Because the owner wasn't afraid of precision work, a five-man job shop here has grown in one year to an organization of fifty skilled workers. It is operating on a 164-hour week turning out products on subcontracts for an Army arsenal and several private armament manufacturers.

Let's look at the situation which fostered this development. In the early days of America's defense production program, almost everyone was seeking easy munitions jobs. The supply of such work was limited, the capacity offered was almost unlimited. Realizing that it could get only a dribble of work in this competition, this firm went after subcontracts for precision parts.

There are still too many firms after the soft jobs. Many would find themselves capable of taking on precision work. And, they would profit as this firm has profited.

The company contracted to deep drill 37-mm. gun barrels for the arsenal, to build gages, jigs and fixtures for a private gun manufacturer. Soon, it was at work on tooling jobs for other armament makers. Right now negotiations are under way for a contract to drill 3-in. gun barrels for the arsenal. In addition to this precision work, a production job is being sought for a product such as shell fuzes.

Not one new machine tool was purchased. To obtain machines in the overloaded machine tool market would have taken months. So, old machines were rebuilt and new ones designed and built to do the specific jobs contracted. In fact each job is improvised by adapting existing equipment or that which can be made. From old angle iron, automobile transmission and other material literally picked off the scrap heap, machines have been made to perform the special tooling work.

The company is most proud of the gun drilling job. On a rebuilt lathe, which had been junked ten years ago, barrels are drilled at a faster rate than at the arsenal. Furthermore, they are drilled to a closer tolerance than specified in the contract. The 37-mm. barrel has a bore of approximately 1½ in. The arsenal specifies that only barrels through which a 1⅛ in. solid rod can be passed without binding are acceptable. The company checks each barrel with a 1 3/16 in. rod and has rejected less than 2 percent.

Four barrels are drilled every 24 hours, a good deal faster rate than at the arsenal. This has been made possible by changing the shape of the drill to provide more clearance and by polishing the drill more highly. When the tool comes off the grinder, it looks good to the eye. But, under the microscope a sawtooth edge can be seen which promotes welding action during the drilling operation. So, all drills are honed and polished. Before tools were handled in this manner, they had to be resharpened every foot and one-half of drilling. Now, one drill is used all the way without resharpening.

Gage work has been put on a production line basis by breaking up each job. One man does the roughing, another the layout, another the grinding and another the finish grinding. Bottleneck situations where all gage makers would be seeking to use the same machine at the same time are thus avoided. The men are shifted frequently so that they will not lose their skill at all operations.

Brainard, Talbott Fill WPB Production Posts

WASHINGTON—George C. Brainard and Harold E. Talbott have been appointed to newly created positions as deputy directors of the Production Division of the War Production Board.

Mr. Brainard has been in charge of the Machine Tools Branch since the first of the year and will continue to direct its activities. He is on leave as president of the General Fireproofing Company.

GEORGE BRAINARD

Mr. Talbott will direct the activities of the present Aircraft Branch, the chief of which is Merrill C. Meigs, and a newly formed Radio and Radar Branch. He has been with the WPB for the last two months as special advisor to Donald Nelson. Mr. Talbott is on leave as chairman of the executive committee of the Electric Auto-Lite Company.

Machine Tool Dealer Must Help Solve Vital Problems

CLEVELAND—The machine tool dealer is a machine tool production engineer and his daily task is to help war contractors solve the manufacturing problems that must be overcome one by one to secure the enormous war output required for victory.

So said George H. Johnson, president of the National Machine Tool Builders' Association and president of the Gisholt Machine Co., addressing the spring meeting of the Associated Machine Tool Dealers of America at the Hotel Cleveland May 1.

Mr. Johnson said that it is the dealer's job to bring to the machine tool builder specific and complete information to enable the latter to do his work with the utmost effectiveness and speed. The dealer's part is to see that the user of machine tools chooses the right type and the correct number of tools and specifies the proper delivery dates. He can be of service also by sending the builder orders which are complete in every detail.

The machine tool industry, declared Mr. Johnson, is rapidly approaching continuous operation. Many plants are there already. The industry is attempting to solve the problems caused by the scarcity of raw materials and is making every effort to simplify and eliminate unnecessary details of finish. It would appear now, continued Mr. Johnson, that machine tool production is so great that the point is rapidly approaching where machine tools can machine all available materials.

George Brainard, Chief of the Tool Section of the War Production Board, spoke at the luncheon meeting on the same program with Mr. Johnson. Morning and afternoon sessions of the association were of an executive nature limited to members only.

War Industries May Hire Girls Under 18—Walling

WASHINGTON—Girls 16 and 17 years of age can be employed in filling government orders in certain industries according to L. Metcalfe Walling, Administrator of the Fair Labor Standards Act and the Walsh-Healey Act. The exemption was requested by War Secretary Stimson and granted since "justice and the public interest will be served."

This will make it possible for employers in the industries covered by the exemption to engage women workers already in their plants and others to be hired on both government contracts and private work.

Among the industries affected by the exemption are arms and ammunition, electrical manufacturing, plastic products, machinery and allied products, and the fabrication of certain metal products.

WARTIME WASHINGTON

Reaction to machine tool allocation order; objection to lawyers' lingo. President chooses wage stabilization as alternative to wage control; unions aren't retreating

BY BLAINE STUBBLEFIELD

WASHINGTON—Advent of the War Production Board's new machine tool allocation order E-1-b was not too unhappy as sized up in Washington's Carlton hotel lobby and elsewhere. Spokesmen for the industry said they thought it would work all right. None of them had any particular aspersions to cast about.

In fact, men of the industry had a hand in writing Order E-1-b. They said that WPB had cooperated with the industry, giving attentive ear to its suggestions and grievances and making changes as the work progressed. It was partly on the advice of the industry that the previously proposed stamp plan was thrown out. It had many faults, among them the fact that cards for each and every machine tool would have filled a corridor full of file cabinets and required several battalions of paper workers.

What the machine tool men did object to was the lawyers' lingo in which the order was written. They said that much valuable time will be wasted by executives trying to read it. In their opinion the document could just as well have been written in plain English. One man said it is a pity that the government must employ lawyers to do such jobs, when they have neither training in writing nor in the problems of production.

Order Not Complicated

There is really nothing very complicated in the order. Elsewhere in this issue, AMERICAN MACHINIST presents it in a form as simplified as possible in the time available, and with some degree of interpretation. Obviously, the War Production Board, in writing this order, was trying to remedy faults in the previous system. One of these problems was uneven distribution of tools to the various fighting services, the shipbuilding program, foreign purchasers, vital non-military industries, and mainly the machine tool industry itself.

This problem seems to have been at least partly remedied in the setting of definite percentages of types and sizes of tools to all of those categories. These percentages cannot be altered except by direction of the Director of Industry Operations himself. Thus the variations from the fixed percentages should be limited.

A second problem was the uncertainty of contractors as to when they would get the tools they had ordered. They had only a priority rating and a position on the Numerical List to guarantee delivery. But the preference rating wasn't a guarantee because new orders with higher ratings came in, under pressure, and previous ones were rooted out. The manufacturer of tools can look at his delivery schedule which is always three months ahead, and tell the customer when he will get his tools. This opinion is expressed in the War Production Board.

A third problem is the piling up of orders on certain manufacturers whose machine tools are popular. These producers dislike to reject orders which they know will go to other manufacturers. To what extent the new system will remedy this difficulty is not yet clear. Presumably tool purchasers can take their choice between waiting and ordering somewhere else. But some men in the industry believe that this difficulty is yet to be solved.

President's Wage Solution

"Stabilization" of wages is the President's alternative for statutory wage controls as part of his anti-inflation program of making everybody poor. It means that instead of a horizontal and probably unworkable freeze, he wants a ceiling on top wages while leaving substandard pay free to rise. How to achieve this is another matter. Roosevelt wants, and has been trying for months to get, a voluntary agreement on the part of labor leadership not to pose any more general wage demands—such as the down-the-line dollar a day increase being asked by most of the big C.I.O. unions.

On this the unions have been adamant. And there is little present prospect that they will retreat from their determination to remain free to fight for a bigger share of whatever civilian goods there are—little prospect except in the somewhat unlikely event that Congress goes all the way with F.D.R. on farm price control, brutal excess profit taxation and a ceiling on incomes.

This unsuccessful push for voluntary agreement has been going on for a long time. The new factor in the situation is that Roosevelt is now prepared, without waiting for labor consent, to go ahead with various kinds of counterpressure against the upward surge of wages. One important measure is an arrangement with the War Labor Board that its decisions will follow the line of the President's policy. This can be very effective unless the unions revolt against a major decision and break up the board by withdrawing their representatives. This is what happened to the old NDMB. But Roosevelt, reportedly, is now ready in such a case to name a board with only public members, and enforce its decisions with plant seizure.

WLB policy, however, can't reach the wage increases that are granted more or less voluntarily by employers—either to avoid labor trouble or to lure workers from other plants. Aimed at this is a scheme now in the works by which federal procurement agencies would refuse to absorb the extra costs resulting from wage increases not authorized by WLB.

The President, too, can exert strong pressure by such means as his public telegram to the shipbuilding stabilization conference in Chicago early this month in which he urged the workers' representatives not to take advantage of contract clauses entitling them to an increase. That such fragmentary approaches to the problem can have at least some effect is demonstrated by the Chicago conference and even more by the nationwide agreement between the War Shipping Administration and the sea-going unions freezing existing wages and conditions for the duration.

New WPB Labor Chief—Wendell Lund (left), newly named chief of the labor production division of the War Production Board was welcomed to Washington by Donald Nelson. Lund was formerly director of the Michigan Unemployment Compensation Commission.

Test of Stanley Subcontracting Plan Makes Progress

Tryout by WPB and Illinois Manufacturers' Association Evokes Interest in Directories and Meetings on Plan — Landry Calls Result "Impressive Beginning".

CHICAGO—Wide interest is being shown and tangible progress made in the tryout this region is giving to the Stanley plan for promoting subcontracting on war production. This interest is manifested by contractors and potential subcontractors. It runs to the three methods involved: first, to the weekly issue of a "Directory of Contract Opportunities" containing current jobs offered by prime contractors, and an index of items, or parts, in those jobs according to a three-letter alphabetical code of the kinds, types, and sizes of machines required; second, to day and evening lecture-and-demonstration meetings; third, to personal calls on "primes" and "subs" by members of the Stanley plan staff in the Contract Distribution Branch, of the War Production Board.

At a meeting attended by 450 members of the Illinois Manufacturers' Association, at the Hotel La Salle the evening of May 5, George A. Landry, Staff Branch Chief, Production Division, WPB, referred to this test as an experiment. He said it had been undertaken by Donald Nelson to demonstrate one method of bringing about subcontracting. Mr. Landry pointed out that the third directory issued, that of May 4, had reached 1,200 companies, that it had listed over 200 items of business to be placed, and that subcontracts for 59 such items had been placed, covering 100,000 hours of work. "Not a large figure," he said, "but an impressive beginning."

This meeting marked the high point of interest here so far in subcontracting and in the Stanley plan. In opening the gathering James L. Donnelly, Executive Vice-President of the Illinois Manufacturers' Association, said that body was cooperating, to help produce the maximum of war materials in the shortest possible time and to help spread business among small concerns. Joseph L. Overlock, Regional Director of the WPB, who presided, said the Stanley plan could be described as one for coding and de-coding machines. Mr. Landry, in his address, stressed the importance of immediate production to get war materials into the hands of our fighting men. He cited "a machine-tool demand which calls for a production of $1,500,000,000 worth in the eight months remaining in this year" as evidence of the field for subcontracting, through using facilities already available.

Mr. Overlock then remarked that Mr. Landry had explained the philosophy behind subcontracting. He next called on James S. Stanley, Consultant in the Production Division of WPB, and originator of the plan. Mr. Stanley, in a brief talk, said the plan represented also the work of eight others, and paid tribute to William L. Libby, of the Navy Bureau of Ordnance, for having worked up the dictionary of machines on which the machine code in the plant is founded. Thomas N. Wynne, manager of the Contract Distribution Branch here, said, "The Chicago office is in pitching for the plan, and we hope it goes over."

The main feature of the evening was a lecture, with blackboard illustrations, and a demonstration, on the use of the plan's directory. This was exactly like the presentation given daily in the Civic Opera Building where the WPB has quarters. It was given by Ralph W. Pritchard, in charge of the Stanley plan office, assisted by Henry Paulman, Thos. N. Bishop, and W. C. Wright, all members of its staff, and Joseph R. Barnes, of the staff of the Illinois Manufacturers' Association. Mr. Pritchard, himself a hard hitter, called his group the "Stanley plan 'commandos.'" They distributed to each of the 450 present, at the start of the presentation, a copy of the May 4 issue of the directory, containing offerings on jobs from twenty-eight companies, all except three listed by corporate name.

Example of Method

Treating his auditors as potential subcontractors, Mr. Pritchard had them follow through the moves to get a subcontract. He had them list machines assumed to be in their shops, according to the code, including one machine described as BAH: B, for drill; A, for bench type, one spindle; H, for $\frac{5}{16}$ in. by 12 in. swing. Referring to the index to jobs, this led to a job on a small cold-rolled steel part, listed by Kearney & Trecker Corp., Milwaukee. Mr. Pritchard stressed the importance of locating jobs of the right tolerances for the machines of the prospective subcontractor. In this case the break-down column headed "closest tolerances required (in 1,000th's) contained the figure "5." He said this meant the tolerance was .005.

In such presentations 138 prime contractors and 452 potential subcontractors have been instructed on the plan. The mailing list for the directory has grown to 1,985. The deadline for listings in it is Wednesday. It is printed at the Government Printing Office, and comes out by mail on Monday.

Listing Gets Six Contacts

E. G. Bradshaw, head of the engineering department of Wells-Gardner & Co., radio manufacturer, contractor on Signal Corps work, listed a gear job. He said his company consequently made contacts with six companies it will use on other jobs, and gave one involving milling and reaming to a subcontractor. This was to C. Cretors & Co., manufacturers of corn poppers. C. J. Cretors, third-generation manager of this company, said that from the May 4 issue of the directory he had secured leads for several additional jobs. E. J. Heimer, general manager of the Barrett-Cravens Co., makers of materials handling equipment, having Army and Navy Ordnance contracts, said he received thirty-two inquiries for a job listed in the first directory, had let a contract on its seven items, to the first of the inquirers, and was going to use some of the others on other jobs.

British-Combine

Practice Makes Perfect—A former housewife working in one of Britain's factories is making rubber shells for use in gunnery practice

Old and New Secretary of Gear Manufacturers Association

J. C. McQUISTON

NEWBOLD GOIN

McQuiston, AGMA Secretary Resigns: Goin Succeeds Him

WILKINSBURG—After serving ten years, J. C. McQuiston has resigned as secretary-manager of the American Gear Manufacturers Association. He is succeeded by Newbold C. Goin, who was formerly sales manager of the Gearing Division of the Nuttall Works of Westinghouse Electric and Manufacturing Co.

Mr. McQuiston has long been identified with industry, and prior to his official connection with the A.G.M.A. was for more than thirty years general advertising manager of Westinghouse Electric. He participated in the founding of the association in 1917.

Mr. Goin has a background of sales and service with Westinghouse Electric and more recently as sales manager of the Gearing Division at that firm's Nuttall Works. He is a veteran of the first World War, having served thirteen months overseas.

NAMES in the NEWS

Guy T. Avery, works manager of Acme Steel Co., Riverdale, Ill. plant, and W. Sheridan Huss, sales manager of the Central District were elected to the Board of Directors at the company's annual meting.

A. F. Boucher, district manager of Lincoln Electric Co., Detroit office, has been called to active duty and will be stationed for the present at the Detroit Ordnance District. His duties will be taken over by C. H. Buckmaster of the Pittsburgh office and J. H. Cunningham of the Detroit office will assume Mr. Buckmaster's position at Pittsburgh. George Bain has been transferred from the Detroit to the Saginaw area.

W. D. Bronson has been appointed district manager of the Chicago territory of Carboloy Co., Inc., to succeed W. W. Fullagar. Einar Almdale has been transferred to this district as a tool service engineer.

George T. Christopher has been named president and general manager of Packard Motor Car Company to succeed M. M. Gilman who recently resigned because of ill health, and also becomes a director of the company to fill Mr. Gilman's place. Mr. Christopher has long experience in the automotive industry and is well known as a manufacturing expert.

N. H. Brodell has been appointed metallurgical sales engineer for Copperweld Steel Co., Warren, Ohio.

Howard W. Broecker, previously connected with the Youngstown Sheet & Tube Co. and Interstate Iron & Steel Co. of Chicago, has been made assistant manager of the Chicago district of Copperweld Steel Co.

Fred S. Doran has been appointed vice president of Joseph T. Ryerson & Son, Inc. He has been with them since 1905.

Four Westinghouse executives have been elected to the rank of vice president. They are Andrew H. Phelps of Pittsburgh, Pa., manager of purchases and traffic; L. E. Osborne of Philadelphia, Pa., manager of the steam division; Frank C. Read, of Jersey City, N. J., president of the Westinghouse Elevator Company, a subsidiary; and Walter C. Evans of Baltimore, Md., general manager of radio, X-ray and broadcasting divisions. All four will continue in their present executive posts. Mr. Phelps joined Westinghouse on January 1, 1937, coming from the McGraw-Hill Publishing Co., where for seven years he served as sales manager and director of public relations.

Frank U. Hayes associated with The Bullard Company for the past seven years has been appointed assistant sales manager.

David W. Jenkins has retired as general sales manager of Henry Disston & Sons, Inc., Philadelphia, after forty-six years and will settle on the Pacific Coast.

W. R. Kuhn has been announced as district manager of the Allegheny Ludlum Steel Corp.'s Cleveland office.

Fred E. Lacey has been elected president of The Lacey Mfg. Co., Bridgeport, Conn., in addition to his position as treasurer, but is replaced as secretary of the organization by S. W. Lasto.

Arthur H. Losey has recently been added to the staff of Hammond Machinery Builders, Automatic Polishing and Buffing Division.

C. D. Mathewson, formerly chief tool engineer of Spencer Lens Co., Buffalo, has become manager and chief engineer in charge of the Buffalo office of the Duncan Tool Designing Co. at 1700 Elmwood Ave.

W. C. Osborne has been appointed superintendent of outside production for

Packard President

GEORGE CHRISTOPHER

Assistant Manager

HOWARD BROECKER

District Manager

W. R. KUHN

American Engines Praised—Two Royal Air Force Pilots inspect an aviation engine crankshaft machined in the plant of Ohio Crankshaft, Inc. They had just addressed hundreds of company employees, praising American engines

Northrup Aircraft, Inc., Hawthorne, Calif. For the past three years Mr. Osborne has conducted his own firm of industrial engineers in addition to a school of methods engineering.

William A. Purtell, president and treasurer of Billings & Spencer Co. and Holo-Krome Screw Co., Hartford, Conn., has been elected a director of the United States Chamber of Commerce to represent the first district.

John Slezak, president of the Turner Brass Works, Sycamore, Ill., is on leave of absence from his position to take up new duties as chief of the Tank and Combat Vehicle Division of the Chicago Ordnance District.

Lawrence Y. Spear has been elected president of the Electric Boat Co., Groton, Conn., while H. R. Sutphen has been named executive vice president and John Hay Hopkins vice president.

Louis R. Wallack has been appointed in charge of industrial relations for Clarke-Harrison, Inc., management engineers of Philadelphia. He has been engaged in public relations and personnel work for the past twenty years.

OBITUARIES

Lawrence J. Becker, 56, for the past twenty years partner in the Sullivan-Becker Machine Shop, Kenosha, Wis., died recently following an operation. He was formerly an assistant foreman of the tool room at J. I. Case Co.

William A. Brubaker of the Akron Gear & Engineering Co. and member of the A.G.M.A. passed away on April 26 at Akron.

Louis J. Dolle, 80, former chairman of the board, Lodge & Shipley Machine Tool Co. and prominent Cincinnati attorney died April 20 at his residence after a year's illness.

Franklin G. Hubbard, president of the Lacey Mfg. Co., Inc., of Bridgeport, Conn., died recently.

William R. Tomlinson, manager of the Hartford Drop Forge Division of Capewell Mfg. Co., passed away. He was formerly vice president and works manager of Billings & Spencer Co. and works manager of Pratt & Whitney Div. of Niles-Bement-Pond Co.

Robert F. Vogt, chief consulting engineer of Allis-Chalmers Mfg. Co. died after a short illness. He had been employed by the company for 36 years.

J. C. Wattleworth, 48, vice president of the Cleveland Automatic Machine Co. died suddenly. He had held that position for the past six years and had served on the Cleveland Heights Board of Education for the last five years.

PLANT EXPANSION

Cooper-Bessemer Corp. is doubling its capacity for production of diesel engines at the Pennsylvania plant by the addition of two new buildings.

Further expansion for engine production has been announced by Pratt & Whitney Aircraft Division in plans for three new plants in New England. They will all be similar size and construction.

Milwaukee Tool & Die Co. has announced plans to spend about $37,000 for expanding its production space.

White Machine Works, Eau Claire, Wis., will erect a $6,000 addition to its plant.

BUSINESS ITEMS

Detroit Rex Products Co. is increasing its service engineering force by adding to its field personnel to handle a new free consulting service on all types of cleaning operations and methods. A New England office at Meriden, Conn., has been established for this purpose.

Electrical Testing Laboratories, Inc., New York City has acquired the plant and equipment of Electrical Testing Laboratories as well as its staff to meet the growing demand for research work of companies which may lack adequate facilities in their own plants.

Hartley Wire Die Co., Thomaston, Conn., has been appointed by Carboloy Co., Inc., as eastern manufacturing unit for the production and servicing of all types of Carboloy dies. The Worcester office of Carboloy will continue.

Phoenix Products Co., Milwaukee has purchased the Barker Metal Spinning Co. to augment the facilities of its newly established Metal Spinning Division.

Woodbury Machine Co., Woodbury, Conn., is organizing a new company to take over the obligations of the old company.

MEETINGS

American Iron & Steel Institute. General Meeting. Waldorf-Astoria, New York, N. Y. May 21.

American Management Association. General management conference. Pennsylvania Hotel, New York, N. Y. June 5.

American Society for Testing Materials. Annual meeting. Chalfonte-Haddon Hall, Atlantic City, N. J., June 22-26.

National Electrical Manufacturers Association, Annual meeting. The Homestead, Hot Springs, Va. May 10-16.

National Metal Trades Association. Annual convention. The Biltmore, New York, N. Y. May 19-20.

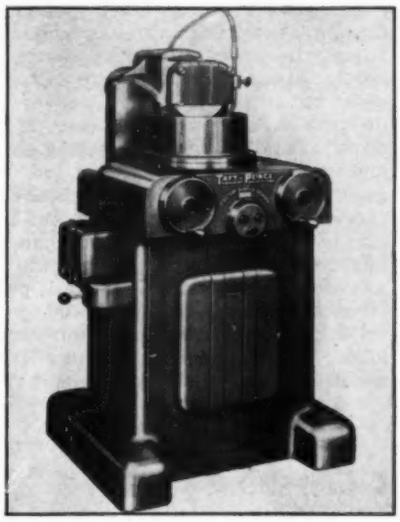
Society of Automotive Engineers. Annual summer meeting. The Greenbrier, White Sulphur Springs, W. Va. May 31-June 5.

SHOP EQUIPMENT NEWS

Tilting Table on Taft-Peirce Surface Grinder Simplifies Grinding to Sharp Corner or Shoulder

The tilting wheel head on the 6-in. rotary surface grinder, produced by the Taft-Peirce Manufacturing Co., Woonsocket, R. I., facilitates operation on shoulder work. The head swivels on a vertical plane about the center of the wheel through an arc from horizontal to 30 deg. below center, with wheel clearance being readily provided. Thus, grinding to sharp corner or shoulder is simplified.

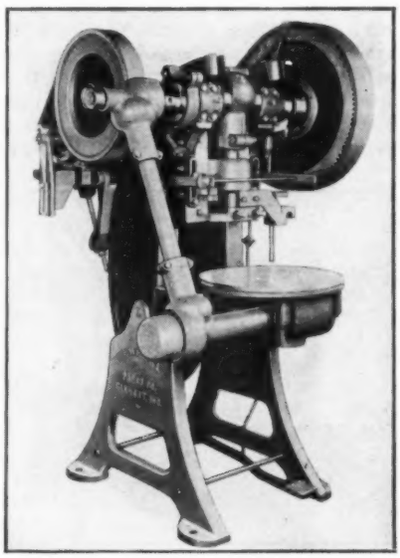
Flat surfaces can be finished within extremely close tolerance limits. The wheel spindle is driven by 1 hp. motor at 3,600 r.p.m. Magnetic chuck with working surface 6 in. in diameter permits the holding of very small pieces of work at the center of the face plate. Work spindle driven by a ¼ hp. motor revolves at 120 r.p.m. Handwheel operates the elevating mechanism through a telescoping shaft and gearing. Large dial, graduated in one two-thousandths of an inch with graduations approximately 3/16 in. apart, make reading and setting accurate. Cross travel of the saddle is 4 in. Wheelhead moves vertically 12 in. at the rate of 0.050 in. per revolution of handwheel.



All Moving Parts Inclosed On Federal Dial Press

Positive indexing and locking mechanism of the dial feed permits unusually high speed with accuracy and safety in a multiple dial feed press, announced by the Federal Press Co., Elkhart, Ind. All moving parts are inclosed, except the dial plate itself, removing the possibility of injury to the operator. Indexing is obtained by a cam and gear arrangement.

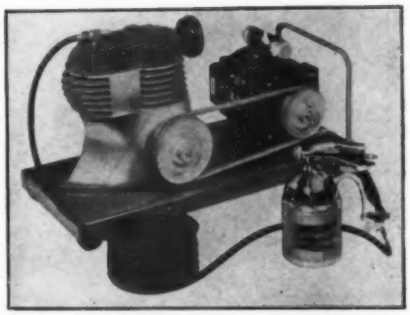
A long or short dwell dial can be obtained, allowing the operator whatever time is necessary to inject the work into the fixture, in the dial station. For greater speed, automatic loading and ejector mechanisms can be furnished. A variety of secondary operations can be handled. Dial feeds are available on eight sizes of Federal presses, from 6 to 80 ton capacities. The smaller sizes have ten stations, the larger twelve stations.



Electric Sprayit Painting Unit Has Balanced Piston Compressor

Paint spraying units designed for medium size general maintenance painting and refinishing work are produced by the Electric Sprayit Co., Sheboygan, Wis. The compressors are balanced piston types, with aluminum alloy piston and connecting rods, providing smooth, quiet performance. Streamlined, pressure-feed spraygun and cup with built-in oil and moisture filter is furnished with each unit. Round, fan and angle spray nozzles are included with the gun.

The Series 380 compressor has a displacement of 4.31 cu.ft. per min., and



Series 670 painting unit has a twin piston compressor mounted on a heavy sheet base

gives an air delivery of 2.75 cu.ft. per min. at 40 lb. spraying pressure. The complete motor compressor unit is mounted on four rubber feet, and the entire unit is finished in a red and silver combination.

Series 460 has a rated displacement of 4.25 cu.ft. per min., and the natural air delivery of 2.68 cu.ft. per min. at 40 lb. spraying pressure. The compressor is mounted on a heavy sheet steel base with four 2 in. diameter, non-marking composition casters, for easy portability.

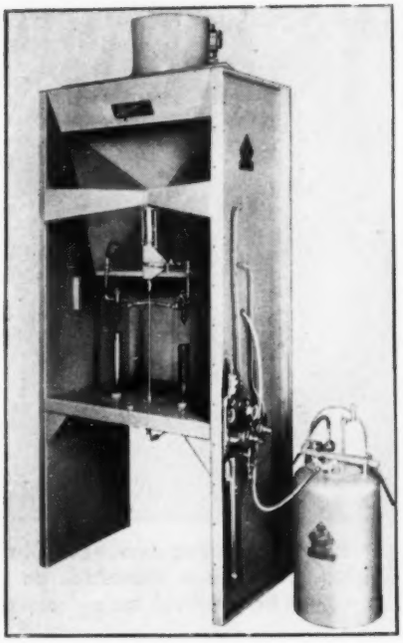
The series 670 unit has a twin piston compressor. Each cylinder of the compressor has a 2¼-in. bore by 1 1/16-in. stroke, giving a displacement of 6.8

The series 380 unit has both motor and compressor in a single housing

cu.ft. per min., and an actual air delivery of 4.15 cu.ft. per min. at 45 lb. spraying pressure. Compressor is mounted on a heavy sheet base, fitted with four 2¼-in. dia. rubber tired castors.

Paasche Airbrush Machine Paints Incendiary Bombs

Two tubular pieces are coated upon their interior surfaces at one time on a machine designed for air painting incendiary bombs, 20 mm., 37 mm., and

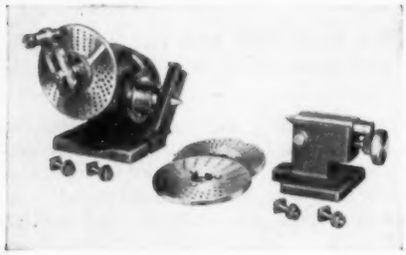


40 mm. shells, by the Paasche Airbrush Co., 1909 Diversey Parkway, Chicago, Ill.

Pieces are placed in holding fixtures which are designed so that they guide the shells to correct position for spraying. The shells rest securely on shoulders, the bottom of the fixtures being open to prevent paint collecting within. From the time the starter button is pressed, the cycle is automatic. Air brushes are lowered the required distance into the pieces to be coated, spraying starts automatically with upward return stroke of cylinder. Spray stops when airbrushes return to starting position, leaving the shell interiors completely and uniformly coated.

Machinery Manufacturing Offers 6-In. Universal Index Centers

Six-inch universal index centers have been introduced by Machinery Manufacturing Co., 1915 E. 51st St., Vernon, Los Angeles, Cal. Index plates will divide all numbers to 50 and all even



numbers to 100 with the exception of 96. Head can be set by means of positive clamp at any angle from 10 deg. below horizontal to 10 deg. past perpendicular. The complete unit has a weight of 30 pounds.

National Broach Speeder Amplifies Noise 50 Times for Sound Checking Gear Accuracy

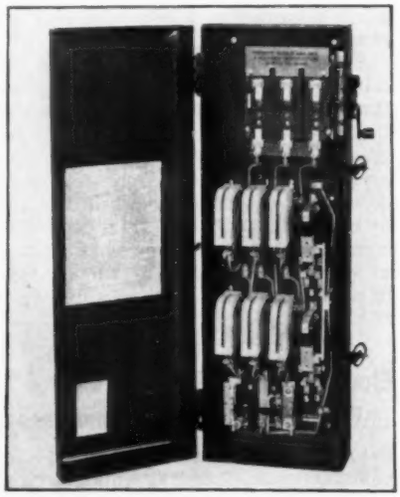
Gears from 1 15/16 to 5½ in. can be sound checked on the Red Ring gear speeder announced by National Broach & Machine Co., 5600 St. Jean Ave., Detroit, Mich. The box is so designed that gear noise is amplified approximately fifty times at the listening point. Interference from sound other than from the gears is eliminated.

The drive is on the lower spindle so that it is not necessary to remove or adjust the drive belt when changing center distance. The upper spindle slide which provides the changes in distance is adjusted by means of a screw. Parallel gage stops on the fixed and movable housing permit use of gage blocks in setting center distances.

All electrical controls are on the inside of the cabinet with speed changer knob, start, stop and reverse buttons mounted at the front. A brake is provided for applying a load to the gear set in order to distinguish sound under load. The a.c. motor provides four speeds forward and four in reverse.

General Electric Starters Provide Full-Voltage Control

Alternating-current combination magnetic reversing starters for full-voltage starting and reversing of squirrel-cage induction motors are announced by the General Electric Co., Schenectady, N. Y.



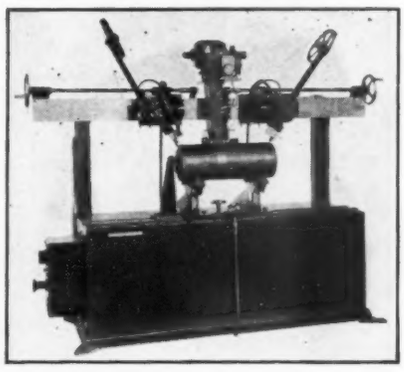
They are suitable for the primary control of wound-rotor motors. These single-unit starters consist of two mechanically interlocked reversing contactors, a two-pole overload relay, and either a circuit breaker or a fusible or nonfusible motor-circuit switch.

The starters are designed to provide full-voltage reversing control and short-circuit protection in one unit. They are completely wired and ready to operate after connection of incoming power lines, outgoing motor lines, and control circuit. The line includes NEMA sizes 0 to 4 starters covering single-phase and 3-phase motors in sizes up to and including 100 hp. at 440 or 550 volts.

Berkeley Welder Handles Seam Around Circumference of Tanks

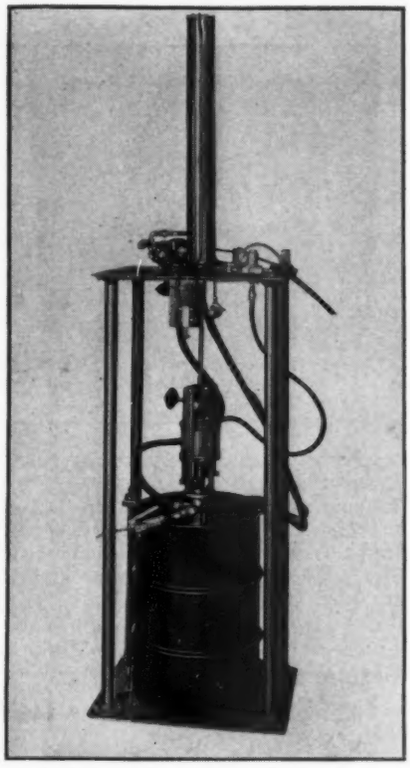
A circumferential seam welder for automatically welding heads in air storage tanks is produced by the Berkeley Equipment Co., Corry, Pa. The machine is arranged to handle varying lengths and diameters of tanks.

A tank with pre-assembled heads is placed on the roller carriage, the carriage lifted by air against the multiple belts which are traveling at a constant (but adjustable) speed. The belts are set at a slight angle to keep the tank against the stop. Upon completion of the weld, the tank is lowered and ejected. Welding speeds are from 12 to 40 in. per min. depending on the gage.



Lincoln Forced-Induction Pump Handles Heavy, Viscous Material

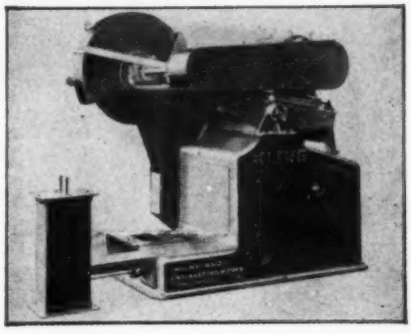
Forced-induction pumps, designed to dispense heavy, viscous materials such as sealing compounds, sound deadeners, insulating material, putty, heavy lubricants and other substances too heavy and solid to prime in any other type of pump, are built by the Lincoln Engineering Co., 5701 Natural Bridge Ave., St. Louis, Mo. Known as the "Pile



Driver", these pumps are available in single or two-stage models. The single stage unit is for use when pulsation in the flow of material is permissible. The two-stage unit has a pulsation eliminator which does away with the pulsation and delivers the extruded material at an even rate of flow and in uniform size and shape as desired.

Kling Saws Aid Production Of Bombs, Shell and Bullets

High speed friction saws for use in the production of bombs, shell and bullets from solid or hollow, hot or cold steel stock have been developed by Kling Bros. Engineering Works, 1300 N. Kostner Ave., Chicago, Ill. The saws are either 36 or 48 in. down stroke with hydraulic feed. Swing frame is actuated by a double-acting hydraulic cylinder through ½ hp. motor and pump. Downstroke of the blade is adjustable up to 2.8 in. per sec. while the upstroke is fixed at 4.35 in. per sec. Fabricated hood shields saw blade and a cooling system directs water to dissipate heat from the blade rim. Finish



pads are provided to receive suitable holding fixtures for the work to be cut. Main motors range in size from 40 to 75 hp.

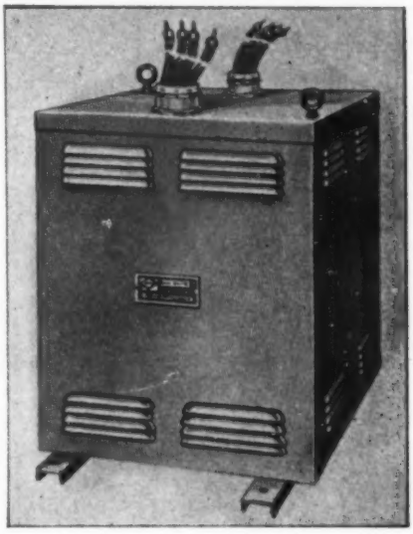
Blake Portable Dust Collector Offered for Grinders, Polishers

A portable dust collector for use with grinding and polishing machines where no central dust collecting system is available has been introduced by Edward Blake Co., 634 Commonwealth Ave., Newton Center, Mass. Motor and fan are located behind the filter so that all bearings are protected from dust

and grit. The filter, measuring 16 × 20 × 2 in., is made from fireproof spun glass. Cleaned air is expelled through a right angle elbow at the back of the filter. Top of the unit is adjustable 7 in. horizontally and 20 in. vertically.

Many Plants Served by Single Acme Air Cooled Transformer

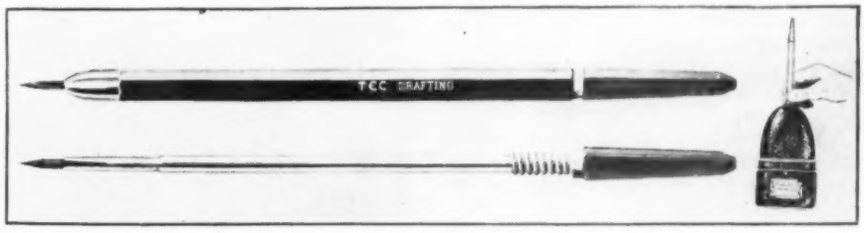
Air cooled transformers with 2,400 volt primary are available in sizes 1.5 kva. in single phase and from 3 to 50 kva. in three phase, from the Acme Electric & Mfg. Co., Cuba, N. Y. For these transformers only one general wiring



system is required for the entire operation of many plants. These transformers are also furnished in three phase designs with primaries of 240, 480 and 600 volts, in sizes from 3 to 50 kva. The 2,400 volt transformer is designed with 5 percent taps in sizes from 5 to 50 kva. This allows for voltage correction to compensate for voltage drop where lines are carried over an extended area.

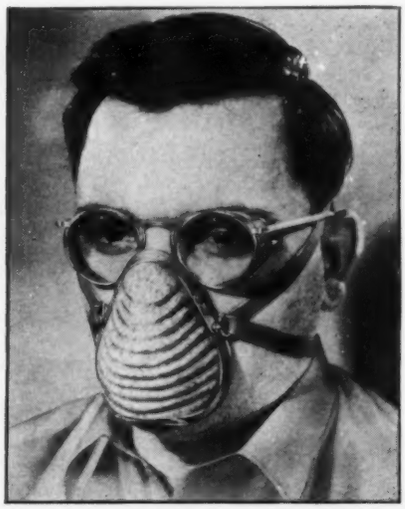
Mechanical Drafting Pencil, Lead Pointer Made by Tec

A mechanical drafting pencil with a motor driven lead pointing machine has been announced by Tec Pencil Co., 9381 Olympic Boulevard, Beverly Hills, Cal. The pencil has a full length lead tube of spring brass. Squeeze action on the lead does not mar or ring the leads causing them to break. The pencil barrel has been balanced and given the feel of a full length wood encased pencil. It is also made in double-end type enabling draftsman to carry two different degrees of lead in one holder. Sharpener which starts and stops automatically provides needle-like points.



American Respirator Protects Against Dusts, Is Light

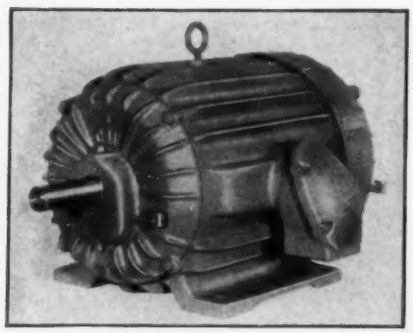
A light-weight respirator giving protection against toxic dusts and providing full vision has been announced by American Optical Co., Southbridge, Mass. The No. R-100-T protector has been approved by the U. S. Bureau of



Mines for protection against toxic and poisonous dusts such as lead, cadmium, arsenic, chormium, manganese, selenium vanadium, and their compounds. Double rubber head-band holds the respirator in place. The unit weighs only 1½ oz.

Crocker-Wheeler Motors Run Trouble Free in Dust Laden Air

Because the ventilating air is blown over the external ribs, instead of through internal passages, trouble-free operation of the cowl cooled motors developed by the Crocker-Wheeler Electric Mfg. Co., Ampere, N. J. is assured, even in atmospheres containing

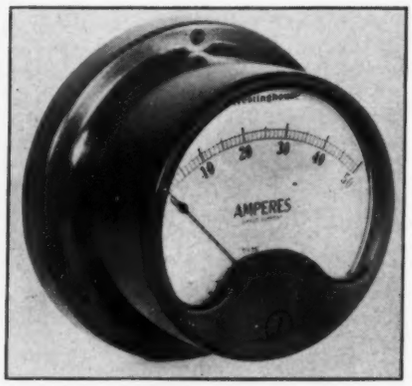


excess amounts of destructive fumes, abrasive dust or dirt. Fans, keyed to the shaft, distributes the cooling air uniformly over all the cooling surface. Ribs on the frame and shields provide large heat-radiating surfaces. These motors are built in standard NEMA frame sizes up to 20 hp. They are rated 220, 440, 550 volt, 3-phase or 220, 440 volt 2-phase.

Westinghouse Panel Instruments Reduce Frequency, Inductive Errors

For radio transmitters, control panels, industrial test units and general test work in electrical laboratories, a line of miniature panel instruments is announced by Westinghouse Meter Div., Newark, N. J. Capacities as low as 20 microamperes are available for d.c. measurements. Self-contained ammeters to 100 amperes, d.c. and a.c., and voltmeters up to 500 volts a.c. and d.c. are also available. Higher ratings may be obtained by using resistors, shunts, or transformers.

On rectifier instruments the dial is calibrated in root mean square values with a sensitivity of from 1,000 to 5,000 ohms per volt. These are used for measuring a.c. values when low energy consumption is important. Thermocouple styles are available with either self-contained or external thermocouples developed for maximum overload and stability, and are used for



measuring radio frequency currents. Frequency errors have been reduced to a minimum, and the overall design is balanced to give the minimum capacity or inductive errors.

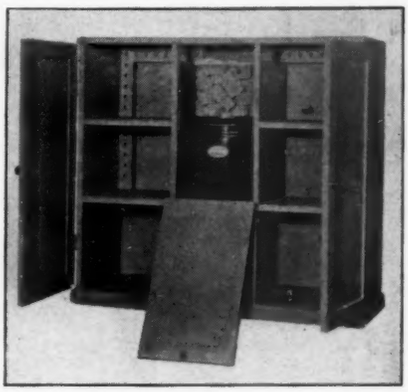
Ideal Cleaning Stone Removes Film, Dirt From Commutators

Film and dirt caused by heavy continuous power loads can be easily and quickly removed from commutators with a cleaning stone announced by Ideal Commutator Dresser Co., 1057 Park Ave., Sycamore, Ill. The operation may be performed while motor or

generator is running. Cleaning stone is held against the commutator and slowly moved across the face. It will not clog or cut the commutator. Film may also be removed from brush seats.

Dehumidifying Cabinet Protects Tools, Dies, Gages From Dampness

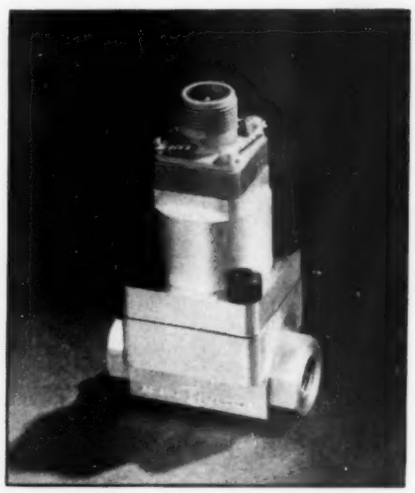
Tools, dies and gages can be protected against effects of excessive moisture in the cabinet-type dehumidifier introduced by the General Air Conditioning Corporation, 4421 Appleton St., Cincinnati, Ohio. Excess moisture is ab-



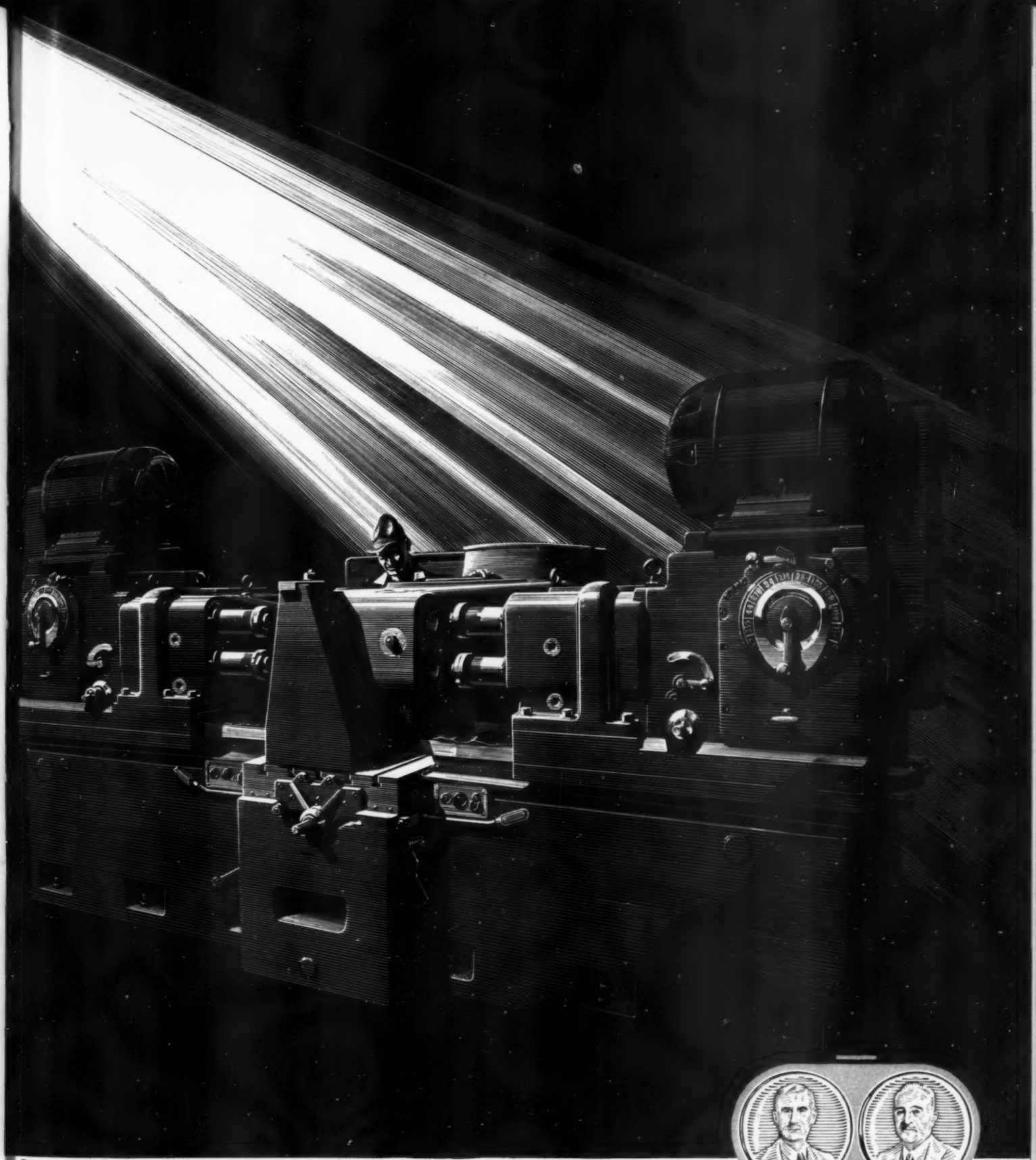
sorbed by chemical dehydrating cubes. Circulation of dry air throughout the cabinet is provided by a flue which runs up both sides to the top of the chemical unit. Cabinet is constructed of wood and is 34 in. high, 38 in. wide and 14 in. deep.

General Controls Offers Valves For Installation on Machine Tools

A series of electric valves, designed for operation on moving equipment and vibrating machines, has been developed by General Controls Co., Glendale, Calif. Applications include valves on machine



tools, airplanes, tanks, ships and trucks. The valves provide positive operation regardless of vibration, movement or increases in acceleration. They will



Another of the many specialized machine tools used in the mass production of Milwaukee Milling Machines.

This special multiple spindle boring machine, developed by our engineers, provides 400% faster production and performs to the consistently fine limits of .0002". This accuracy is made possible by the use of stub boring bars, rigidly journaled in the special heads. It is used for the simultaneous boring of overarm holes, spindle and secondary shaft holes on horizontal milling machines—spindle blocks on bed type milling machines and on arbor supports. Note size of machine in comparison with operator whose head appears in center of illustration.

KEARNEY & TRECKER CORP., MILWAUKEE, WIS., U. S. A.

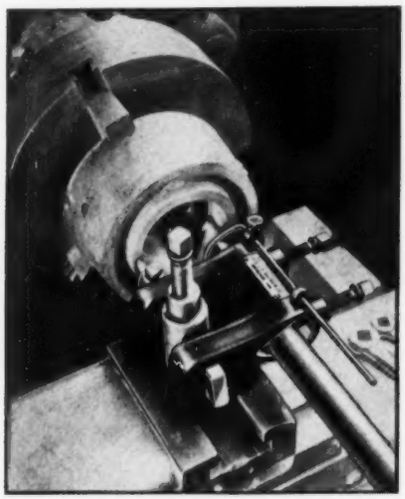
KEARNEY & TRECKER
CORPORATION
Milwaukee
MILLING MACHINES

Milwaukee MILLING MACHINES

handle all types of liquids, gases, and vapors at pressures up to 1,500 lb. Operating in any position, they are packless, drip-proof compact, and light with no sliding parts.

Walker Boring Bar Holder Has Gage to Set Depth of Bore

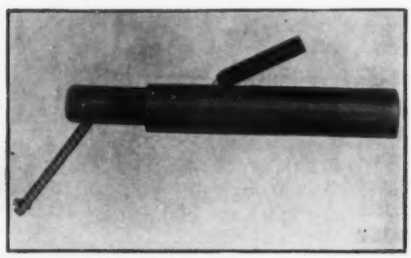
A sturdy boring bar holder, the Walker Hole Hog, is distributed by National Engineering Products, Inc., Commerce & Savings Bldg., Washington, D. C. It is manufactured by C. T. Walker Co.,



254 Stockton Ave., San Jose, Calif. By reversing the tool holder, outside turning can be done on large diameters that cannot be reached with the ordinary turning tool. The holders are provided with a gage which is quickly adjusted for boring, setting, chamfering, and counterboring to a shoulder. The gage is set the required distance back from the point of the tool bit. When a gage contacts work the desired depth has been reached. The bottom part of the holders have ample stock to allow for fitting to the individual lathe which is necessary because of the variation in distances between top of compound rest and lathe centers.

Tweco Electrode Holder Used in Narrow Quarters

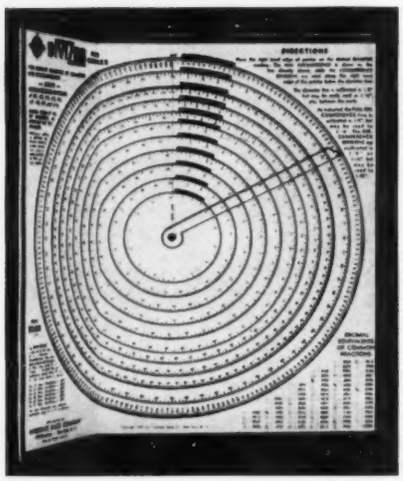
A compact electrode holder which permits close-quarter work at correct angles is manufactured by Tweco Products Co., English at Ida, Wichita, Kans. They are fully insulated. The "Hol-Grip Jr." holder weighs 8 oz. and is 7 in. long. Using No. 4 welding cable it



has a capacity of 150 amp. It takes 1/16 to 5/32 in. electrodes. Where full-time use the holder is not required, it is furnished with a 5 or 10-ft. whip end cable with special fitting for clamping into regular heavy duty holders. The cable can be quickly detached from heavy duty holder.

Circle Measurements Read Easily on Interstate Divizor

Diameters and circumferences of any circle up to 72 in. in diameter can be read instantly on the Divizor offered by the Interstate Sales Co., 1123 Broadway, New York, N. Y. Readings are in steps of ⅛ in. or less. circumference divisions of ½ down to 1/16 may also be calculated. To obtain a reading the pointer is set at the desired diameter. The full circumference is shown on the outer circle, while the circumference divisions are read along the right-hand

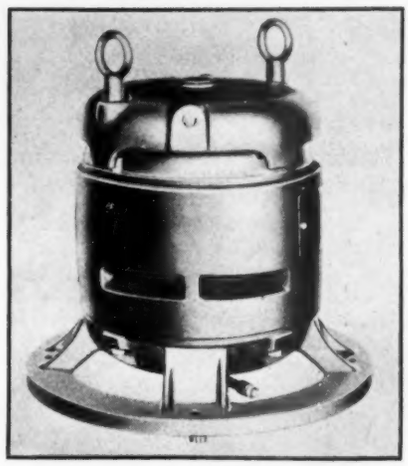


edge of the pointer on the circles within the diameter line. The calculator measures 12×12 in. flat, and it holds to 12×4½ in. Since the layout is relative, readings can also be made in feet, yards or other units.

G. E. Builds Tri-Clads For Pumping and Machine Tools

Three tri-clad motors—a vertical general-purpose polyphase motor, a vertical shielded polyphase motor (1 to 20 hp.) and a vertical shielded single-phase motor (1 to 5 hp.)—are offered by the General Electric Co., Schenectady, N. Y. The shielded-type motors are suited to pumping applications, and the general-purpose motor is suitable for use in the machine tool industry as well as for agitators, mixers and similar applications.

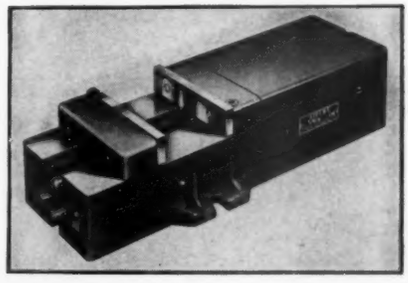
The compact, cast-iron frame and cover of the general purpose motors are designed to give added protection to electrical parts, without adding materially to the over-all height. The use of Formex wire, new punchings and coil shapes, double-end ventilation and balanced design contribute to long life.



The polyphase shielded-type motors are available in either solid-shaft or hollow-shaft construction, while the single-phase shielded-type motors have only solid-shaft. Both shielded types are for normal-thrust or high-thrust applications. The cover is contoured to deflect dripping liquids and falling objects. All openings in the stator frame and end shields are protected against the entrance of splashing liquids. Air is discharged downward at low velocity, thus limiting dust disturbance around the motor.

Senior Pneumatic Vise Offered By Production Devices, Inc.

The senior model pneumatic vise introduced by Production Devices, Inc., 1169 Main St., East Hartford, Conn., can be used for milling, broaching,



shaping, drilling and tapping, as well as bench operations. The vice is 22⅝ × 8½ in. with a Jaw width of 7 in. and maximum opening between jaw castings of 7 in. Gripping force on work is 50 times air line pressure. Foot, hand, cam, air or electrically operated valves can be used with the vise.

Reeves Pulley Announces Remote Speed Indicator

The Reeves Pulley Co., Columbus, Ind., announces an electric remote speed indicator for use with variable speed transmissions and the Vari-Speed motor pulley and Motodrive. The instrument gives a reading in terms of speed rating of the output shaft of the

Faster for Fighters..

BY SAVING SET-UP TIME

The flexibility of modern lathes saves vital time in short runs of small parts, such as the gear blank illustrated. On this work, diameter is turned, side is faced, hub formed and corners radiused, in one setup. The lathe used is a Monarch 16″ Model W, with air equipment for quick chucking and unloading, a 4-way carriage turret, positive length-stop and micro-gaging dials.

While this method may seem elementary to some large producers, it permits faster production of thousands of small parts in small and large plants alike, where every minute saved is important.

The adaptability of Monarch lathes to a wide range of jobs has never been more forcibly demonstrated than now—where they are at work in thousands of small and large plants throughout our country, turning out the implements of victory, faster for fighters.

THE MONARCH MACHINE TOOL COMPANY · · · SIDNEY · OHIO

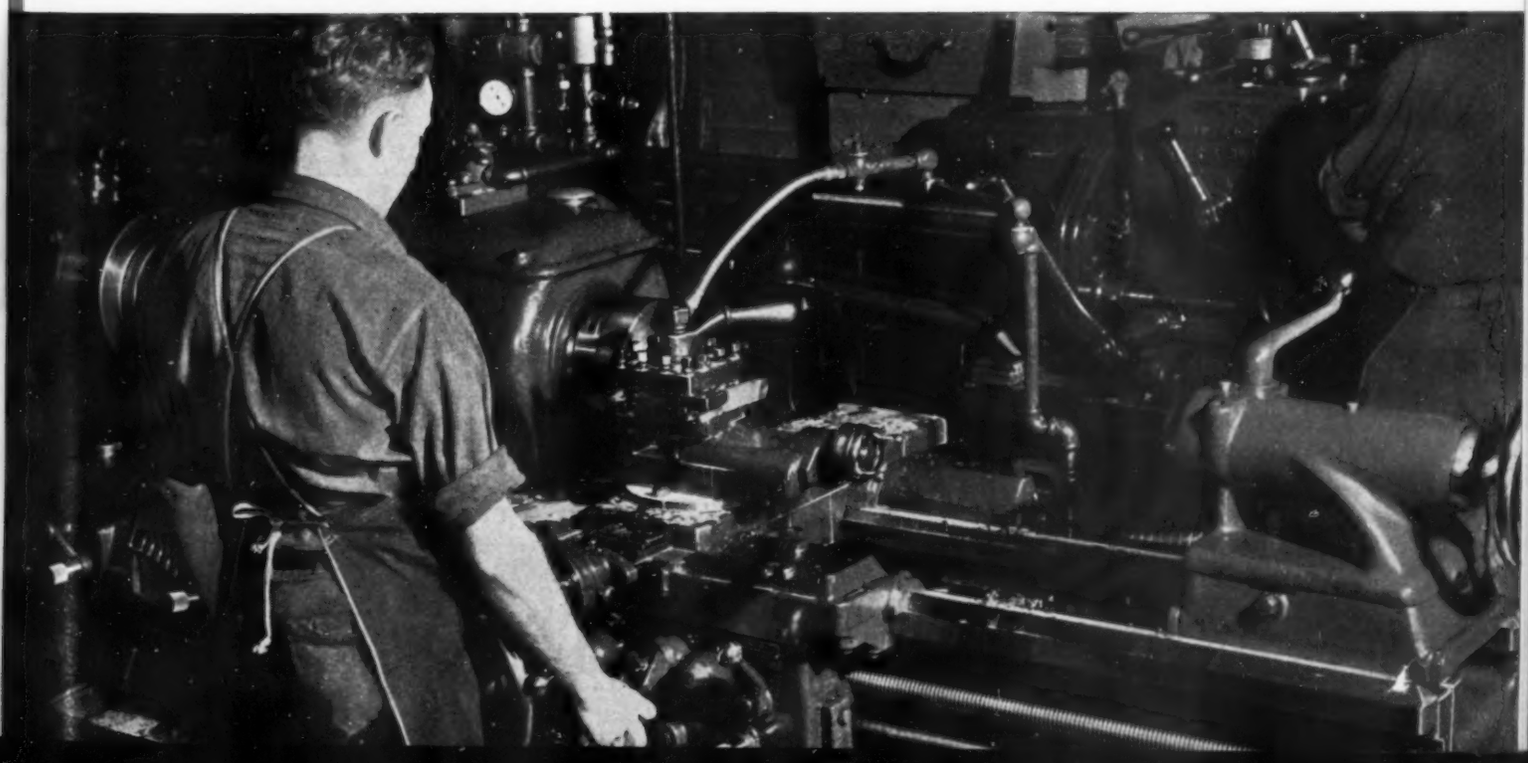
HERE'S THE WAY THIS JOB IS DONE

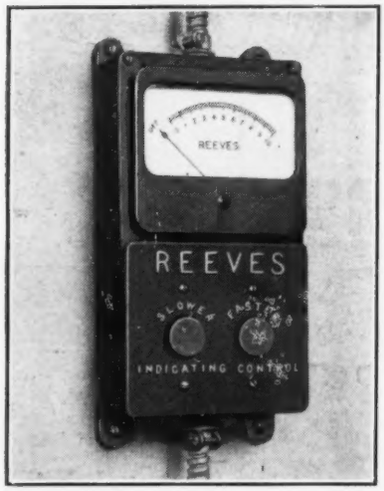
1. Load blank on air-operated arbor.
2. Turn diameter with tool being held in turret.
3. Face side, using two tools, front tool facing to arbor, rear tool to form hub being offset correct distance from front tool.
4. Radius corners, using double radius tool, with left and right radius.
5. Remove blank from arbor.

Material—SAE-2350 steel.
Tools—cemented carbide.
Total time—4½ minutes per piece.

MONARCH LATHES

COVER THE TURNING FIELD

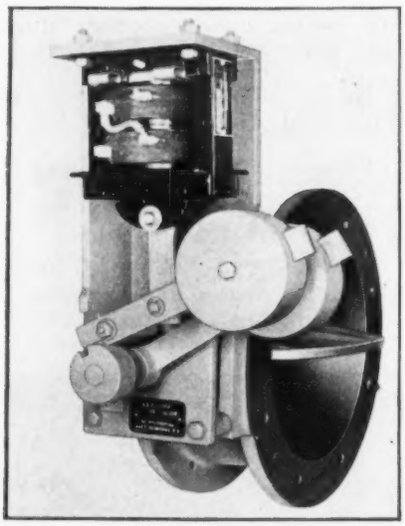




drive. Actual rate in r.p.m. is not shown but the proportionate speed to the speed rating of the drive is easily read. Users can make a chart to show indicator readings corresponding to r.p.m.

R-S Announces Automatic Valves For Emergency Operation

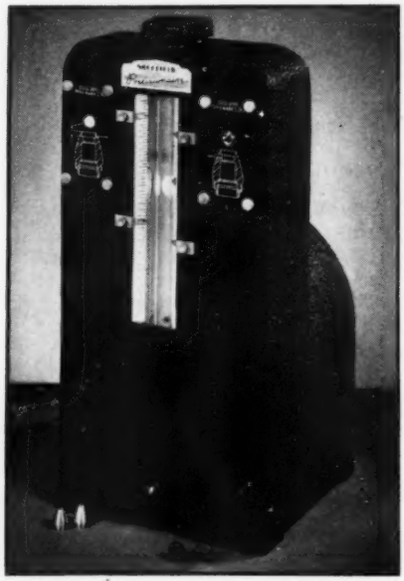
Solenoid operated valves for automatically shutting off flow due to any emergency have been introduced by the R-S Products Co., 4530 Germantown Ave., Philadelphia, Pa. In open position but-



terfly vane is held by the magnetic action of the solenoid. If electric power is shut off for any reason, the trigger is tripped, and the counterweight closes the vane. Valve must be reset by hand. It may be used for air, gas, steam, oil, hydraulic and other services.

Sheffield Combines Gages For Internal, External Checking

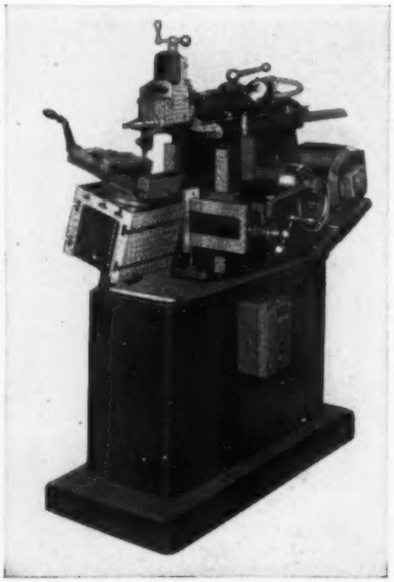
External or internal diameters and depths are checked simultaneously with the Precisionaire-Multichek manufactured by the Sheffield Corp., Dayton, Ohio. The unit combines the Sheffield Precisionaire and Multichek gages. One section of the gage measures the rate of flow of air passing between the gaging spindle and the internal diameter. Another section takes the outside meas-



urements. The two indicating tubes for the Precisionaire gage are placed near the Multichek signal light so that an inspector can readily determine whether the part being checked is within the specified tolerances.

Shaper With Swivel Table, Jaw Vise Made by Sales Service

The Sales Service & Mfg. Co., 473 North Cleveland Ave., St. Paul, Minn., has developed an 8-in. shaper with a swivel table and a swival jaw vise. The table is mounted on a cross-rail saddle and can be set to any angle. Graduations to 180 or 90 deg. indicate setting of table. Gears are mounted on antifriction bearings. They are lubricated through a special lubrication.

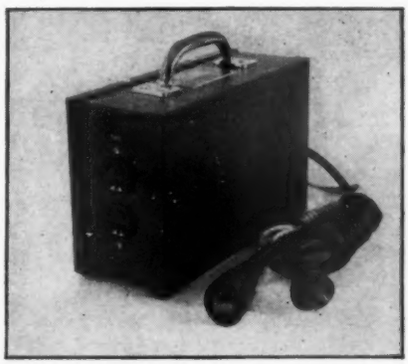


Industrial Instruments Offers Bridge to Test Capacitors

For production testing capacitors and resistors, Industrial Instruments, Inc., 156 Culver Ave., Jersey City, N. J., has developed a high-speed limit bridge. Model LB-1 covers a wide range of capacity from 0.001 to 1.1 mfd. in 0.001 mfd. steps. Bridge, however, can be used for other ranges. The estimate is entirely self contained and operates on 105-130 v. 50-60 cycle a.c.

Acme Transformer Provides Safe Service in Danger Areas

A safety transformer manufactured by the Acme Electric & Mfg. Co., Cuba, N. Y., provides a.c. service in locations where high voltage sparks might cause considerable damage. The unit may

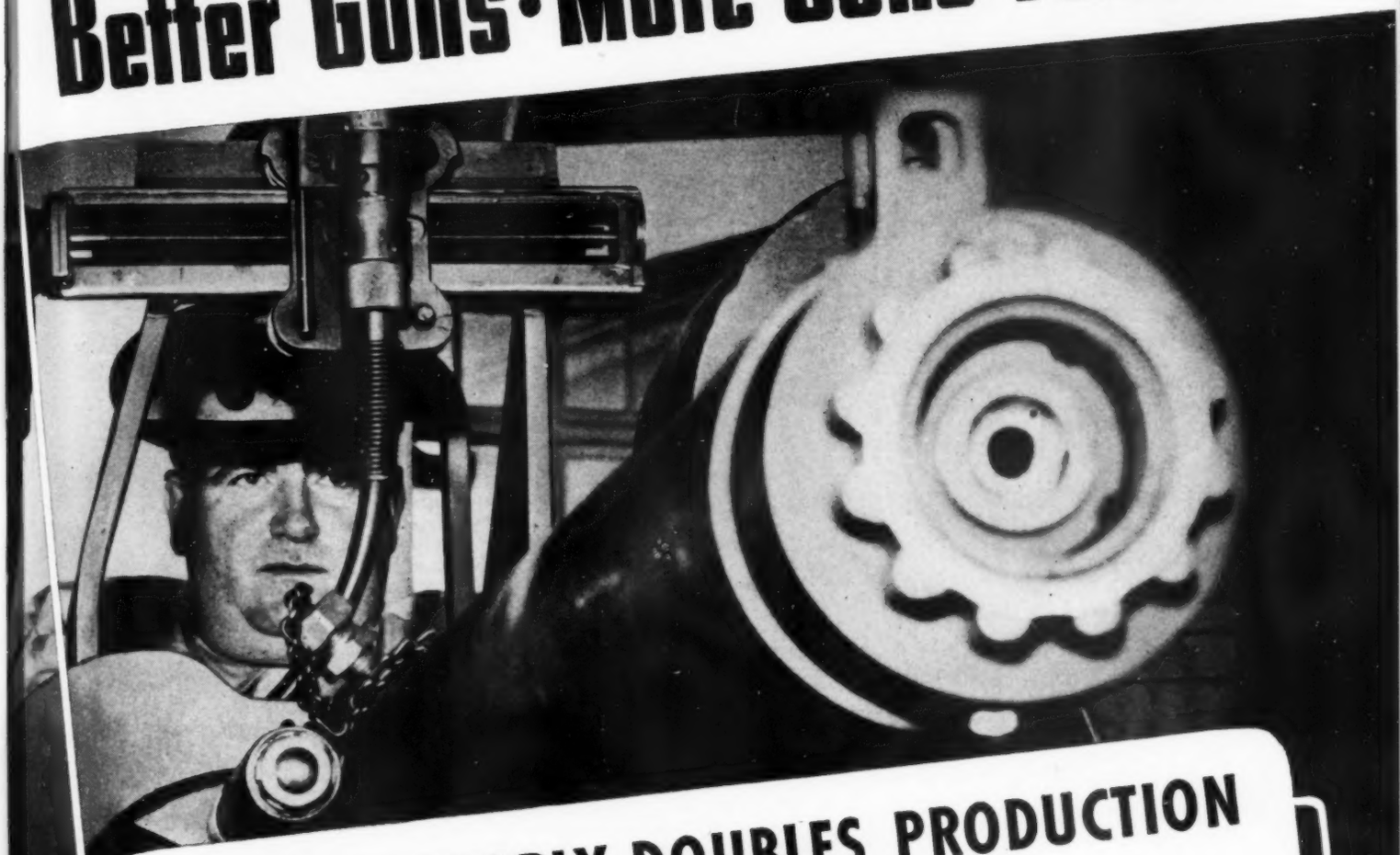


be used where explosive gases exist. The transformer can be plugged into any ordinary 110 volt a.c. circuit and has receptacles for two 32-volt extension lines and a plug-in for inspection lights.

Wabash Appliance Redesigns Blackout Bulb; Changes Color

The Wabash Appliance Corp., 335 Carroll St., Brooklyn, N. Y., has redesigned its blackout bulb. Color of the light has been changed from blue and red to the deep orange recommended by the Office

Better Guns • More Guns • *Faster!*



SUNICUT NEARLY DOUBLES PRODUCTION

Increases Tool Life 60%

Guns and more guns is the aim of America today — produce better guns . . . more guns . . . faster! That's exactly what one munitions manufacturer achieved when he called in a Sun Oil Engineer . . . one of those Doctors of Industry.

A change was made to Sunicut, the free-flowing, transparent sulphurized cutting oil, on machines producing parts for anti-aircraft guns. The improvement was noticeable almost immediately. Tool life increased 60% . . . finish was improved . . . and the output of vitally needed parts boosted from 2½ pieces per eight hour shift to almost 4½ . . . nearly doubling production.

That's another typical example of how Sunicut and Sun Oil Engineers are helping America step up production for victory!

Throughout the war industries . . . wherever metal cutting problems arise . . . Sun's Doctors of Industry and this extraordinary cutting oil stand ready, willing and able to help. Call on them to improve production in your plant. For helpful case histories of what they have accomplished in other leading metal working plants, write for your free copy of "Helping Industry Help America."

SUN OIL COMPANY • PHILADELPHIA

Sponsors of the Sunoco News Voice of the Air—Lowell Thomas

SUNOCO

SUN PETROLEUM PRODUCTS.. HELPING INDUSTRY HELP AMERICA

of Civilian Defense. The new bulb is smaller, consumes less current, eliminates the previously built-in reflector and has a heavy black silicate coating to prevent light leakage.

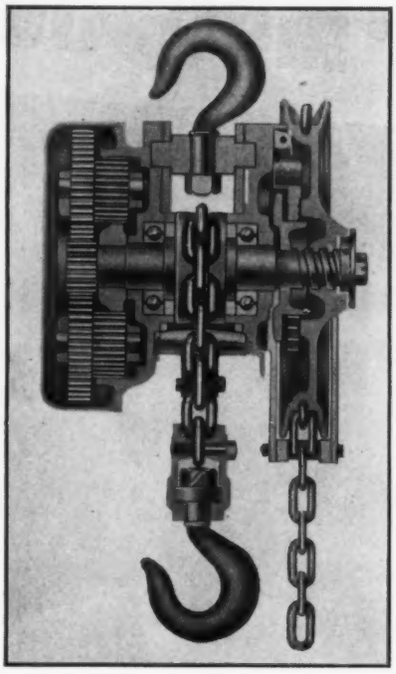
Synthetic Rubber Oil Seal Developed by Graton & Knight

A synthetic rubber oil seal is offered by the Graton & Knight Co., 349 Franklin St., Worcester, Mass. The sealing member will operate over a wide range of temperatures from —40 to 250 F. It is mounted in a one piece metal housing.

The lip maintains sealing contact on the shaft without the use of cumbersome springs. Close tolerances are possible. There is no change in dimensions while in storage or in use. Compound will not wear the shaft, and the seal shows no sign of wear after long periods of operation.

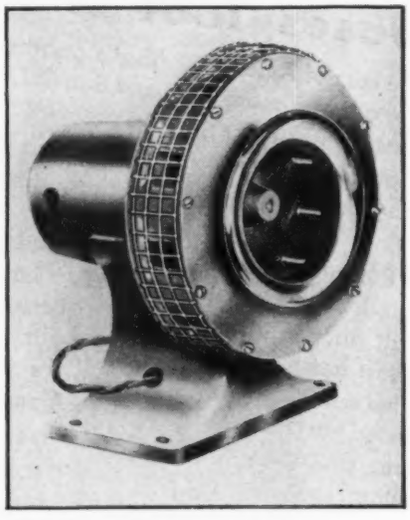
Suspension Plate Strengthens Coffing Spur Geared Hoist

The heavy suspension plate on the Model YC spur geared chain hoist announced by Coffing Hoist Co., Danville, Ill., provides unbreakable support between top hook cross-head and load sheave. Thus weight is less and headroom is greater. These plates support the saddle for double chain hookup and eliminate the use of a top yoke. Six sizes are available: ½, 1, 1½, 2, 3 and 4 tons.

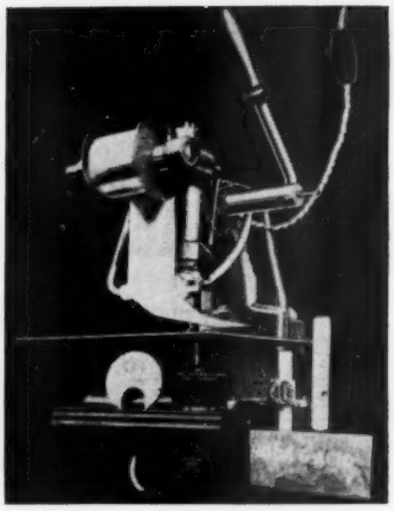


Two Warning Sirens for Plants Announced by Breuer Electric

An air-raid warning siren for use in industrial plants is announced by the Breuer Electric Mfg. Co., 5100 Ravenswood Ave., Chicago, Ill. There are two models. One is for small departments, offices, laboratories or stockrooms, and the other for manufacturing areas where it is essential that the siren be



heard above the usual shop noises. Sirens are equipped with universal motors for either a.c. or d.c. They operate from any light circuit and are equipped for either vertical or horizontal mounting.

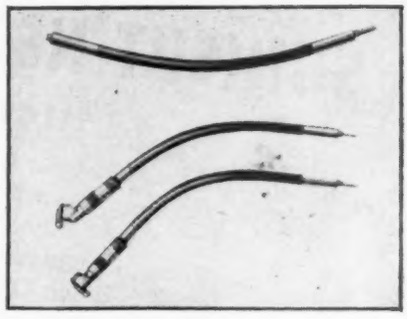


Acromark Bench Machine Marks Parts and Materials

A bench type machine for making parts and materials that formerly had to be engraved is offered by The Acromark Corporation, 9-13 Morrell St., Elizabeth, N. J. Solid dies or interchangeable type are used. Colors may be transferred to the part on the faces of the letters only. The unit is suitable for marking instrument panels, valves, identification tags, nameplates and other products. Will mark parts up to 1 in. thick with an area up to 1x3 in.

Flexible Shaft Extensions For Drills Announced by Stow

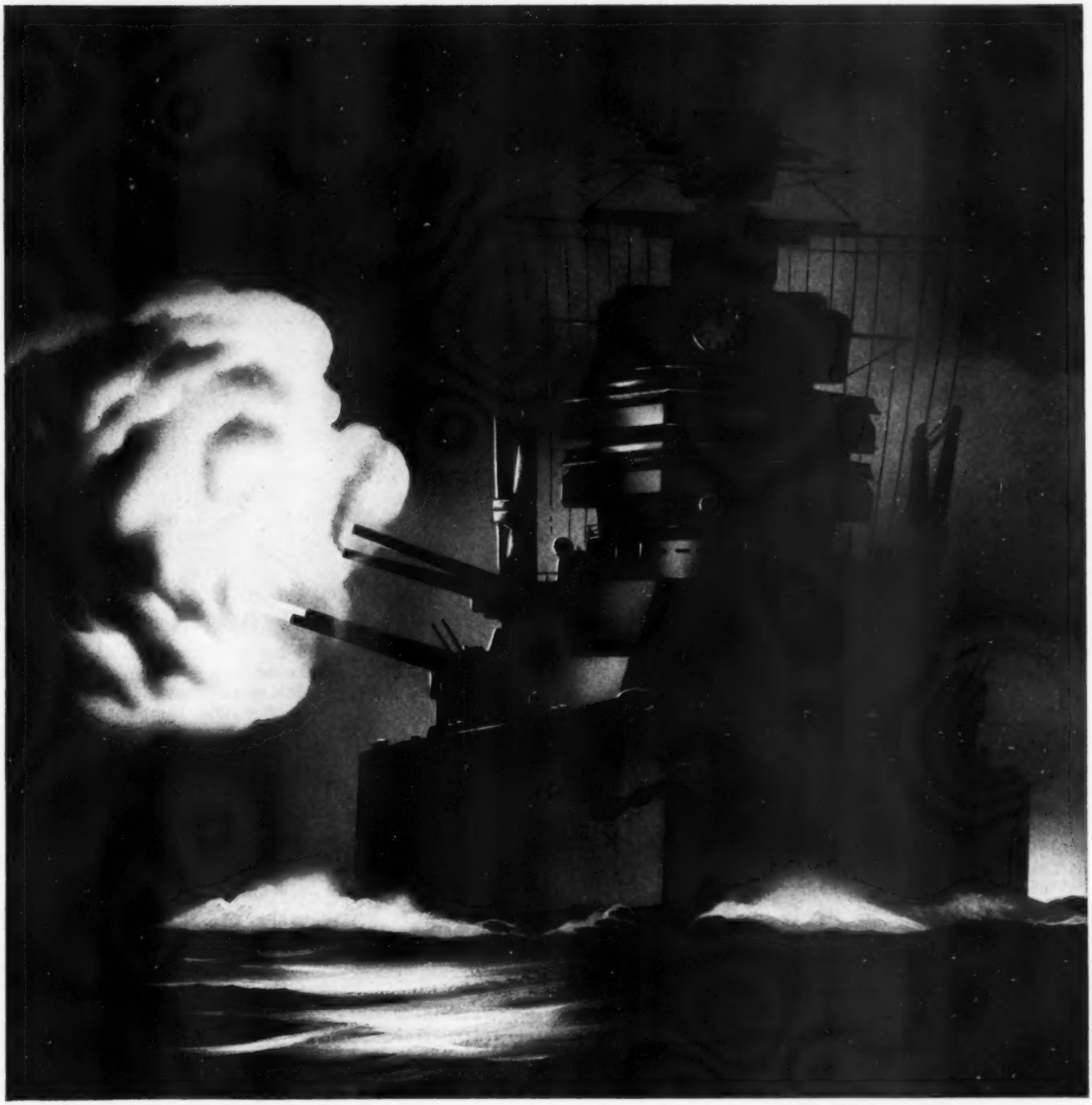
Flexible drill shaft extensions which can be attached to electric drills to provide one-hand operation in tight spots



are available from Stow Manufacturing Co., Inc., Binghamton, N. Y. Three heads are available: straight, 45 deg. and 90 deg. There are four shaft lengths—18, 30, 36 or 48 in. Extension is particularly usable for locations where regular drills are too large. Drills of any size up to No. 30 can be used.

Westinghouse Offers Luminaire For Service in Fumes, Moisture

A vapor-tight Luminaire for incandescent or mercury lamps has been announced by the Westinghouse Lighting Division, Edgewater Park, Cleveland,



MOLYBDENUM ENLISTS FOR THE DURATION

The enormous increase in requirements of molybdenum has necessitated the War Production Board Order M-110, placing molybdenum consumption under allocation control...Our metallurgical research staff is fully engaged in war work. At our mine, mill and converting plant, every effort is being made towards maximum production.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
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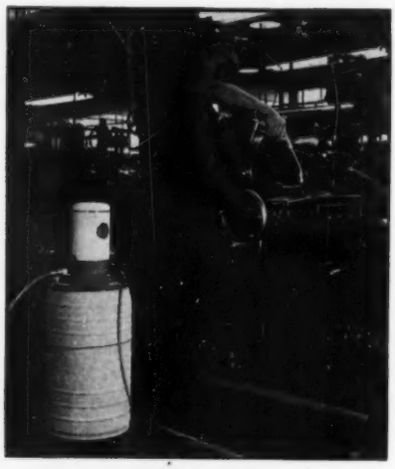
MOLY

Ohio, for use where acid fumes, dust, smoke or excessive moisture is present. Because of its weatherproof construction, the Luminaire can be used satisfactorily for outdoor applications. There are five sizes available—300, 500, 400, 750, and 1,000 watts. Impact resisting glass lens, ¼ in. thick, is designed to withstand sudden temperature changes.

Riegel Paper Corp. Provides Anti-Corrosion Wrapping Paper

The Riegel Paper Corp., 342 Madison Ave., New York City, has extended their line of anti-corrosive, oil-proof papers to provide high strength, pliability and moisture-vapor proofness in such forms as rolls, sheets or bags.

Machined metal surfaces are protected by corrosion-inhibiting oily or waxy materials, but when parts are being shipped to plants thousands of miles away and may lie idle until an emergency calls for their use, the coated part must be wrapped in a paper which will not absorb these corrosion inhibitors or allow them to pass through to the outer container. Ordinary papers are acid and corrosive, making the use of special anti-acid, anti-corrosive papers necessary in many cases.

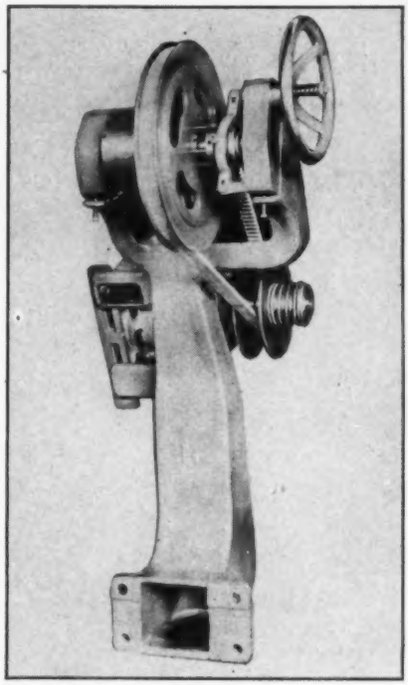


Aro Pressure Lubricator Designed for Machine Tools

A high pressure lubricator for use on machine tools such as turret lathes, has been developed by the Aro Equipment Corporation, Bryan, Ohio. The drum cover type unit provides service direct from standard 100-lb. grease drum. Two-wheeled truck makes it conveniently portable. Either single measured-shots of grease or continuous flow for rapid filling of large cavities are delivered by this machine.

Given Vari-Speed Drive Used on Many Machine Tools

A vari-speed drive unit for use on engine lathes, drill presses, shapers and other machine tools is announced by the Given Machinery Co., 3855 Santa Fe Ave., Los Angeles, Calif. Hand-wheel sets speeds and eliminates shifting belts



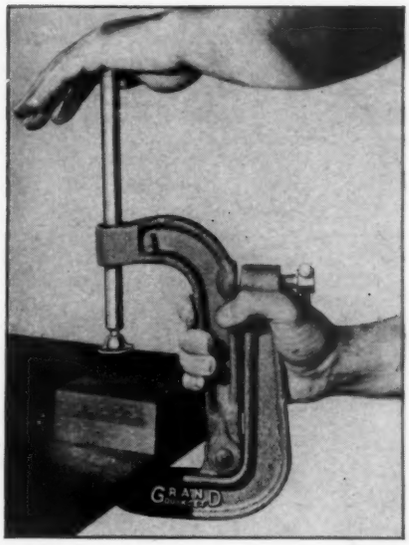
or gears. Speed changes can be made without stopping the machine. The unit is installed with four bolts and in such a manner as to insure non-interference with machine operations. Sizes range from 1 to 10 hp.

Pulmosan Powder Smothers Fires Started by Magnesium

Magnesium fires can be extinguished with the powder introduced by Pulmosan Safety Equipment Corporation, 176 Johnson St., Brooklyn, N. Y. The powder is non-absorbent, finely pulverized and smothers fires caused by magnesium shavings.

Ratchet Rod Replaces Screw On Grand Specialties Clamp

A ratchet rod instead of turn screw operates the clamp offered by Grand Specialties Co., Chicago, Ill. The clamp is first fed to the work with the ratchet



rod. A spring activated pawl holds the ratchet. Then, a screw at the back provides fulcrum action exerting downward pressure on the work.

Athea Lotion Protects Skin From Soaps, Grease, Chemicals

A lotion for skin protection under industrial conditions has been announced by Athea Laboratories, 1568 W. Pierce St., Milwaukee, Wis. It replaces natural oils lost through repeated washings in alkaline soaps, keeps grease and grime from imbedding deeply in the pores and fine wrinkles of the skin, and resists chemical irritants found in coolants, cutting oils and lubricating oils.

Skin Disorders From Cutting Oils Avoided by Natriphene Product

Skin disorders caused by bacterial or fungus infestations in cutting oils, drawing oils, core oils and similar compounds is prevented by a product of the Natriphene Co., 3337 Book Building, Detroit, Mich. This product is an odorless, water soluble germicide in tablet form. The tablets are dissolved at the rate of one per gallon of emulsified oil base or compound. This solution is added to cutting oil base before dilution with water. Tablets are dissolved in alcohol before adding to paraffin base oil. Tablets are said to also prevent odors and decomposition of oils by preventing or retarding bacterial or fungus growth.

Littelfuse Panel Lamp Shows Breaks in Electrical Circuit

Breaks in electrical circuit are instantly indicated by a small panel-mounted light manufactured by Littelfuse, Inc., 4757 Ravenswood Ave., Chicago, Ill. The light goes on when circuit is broken. The unit can be had for 24 or 48 v. filament bulb with which no resistor is used. Otherwise it takes a built-in 200,000 ohm protective re-

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FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

BLAST FURNACE MEN SPEED IRON PRODUCTION FOR MORE FIGHTING STEELS

With the precision of a gun crew in action, a team of skilled men jumps to the task of replacing a burned-out tuyere in their blast furnace. Tools, parts and materials always ready, they snap into action. In a matter of minutes the job is done. The blower opens the wind valve. With a rush and roar the hot blast is on again. Iron for war steel keeps on smelting.

It is this work-coordination of men and management that sets today's record-breaking production pace at J&L.

No waste motions here, no wasted minutes, for these men at the blast furnaces and throughout the works are determined that fighting steels and more fighting steels shall be made *today*.

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AMERICAN IRON AND STEEL WORKS • PITTSBURGH, PENNSYLVANIA

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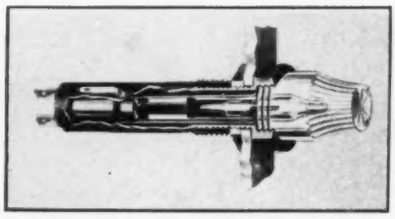
J&L STEEL



sistor in series with a neon lamp. The lamp glows on current as low as 100 microamperes. It mounts on panels up to $\frac{1}{16}$ in. thick and in holes of $\frac{1}{2}$ in. diameter. Length in back of panel is 2 in., while it extends $\frac{7}{8}$ in. on panel face.

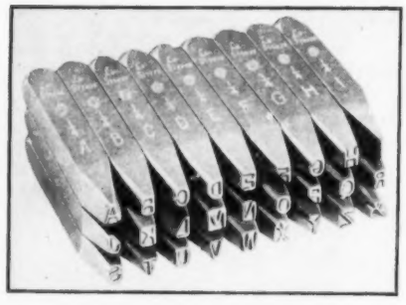
Hygrade Sylvania Fluorescent Lamp Operates in Low Temperatures

A fluorescent lamp has been designed for low temperature operation by the Hygrade Sylvania Corp., Salem, Mass. It is designed to start and operate

satisfactorily at temperatures as low as 0 F. Standard lamps do not operate efficiently at temperatures below 50 F. The lamp is 40 watt and has an estimated life of 1,500 hours.

Matthews Round-Face Characters Suitable for Marking Aircraft Parts

Round-face characters for marking parts placed in torsional or tensile stress, have been introduced by J. H.



Matthews & Co., 3942 Forbes St., Pittsburgh, Pa. The characters have been designed for marking aircraft tubular or heat-treated parts. The rounded impression provides minimum stress set up by permanent marking. Stamping and roller dies with the same characters as well as steel type and hand stamps are available.

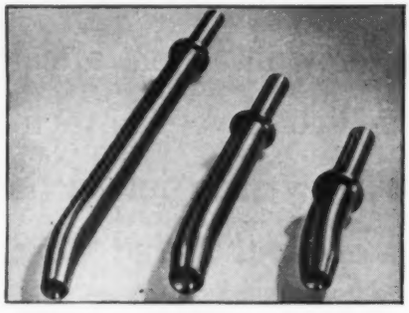
Finish Polishing Performed With H & H Abrasive Pad

A rubber-abrasive polisher for removing the last few thousands of an in. and producing mirror-like polished finish on such jobs as dies and molds

has been developed by H & H Research Co., 12540 12th St., Detroit, Mich. The polisher is a rubber pad impregnated with abrasive and mounted on a 2 in. offset holder. Sizes up to 3 × 1 in. are available. Grits range from 80 to 180.

Angular Offsets Built into Aero Tool Rivet Sets

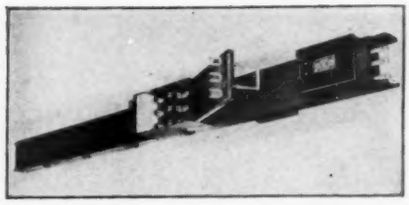
Angular offsets of 7½ deg., 10 deg., and 15 deg., are incorporated in a line of rivet sets announced by the Aero Tool Co. Burbank, Calif. Incorporated in



the manufacturing is a process known as Micro-glass polishing, which is said to develop a glass-smooth face that will not harm aircraft skins or other surfaces the tools contact.

Goodyear Improves V-belts With Tough, Black Cover

Multiple V-belts manufactured by Goodyear Tire & Rubber Co., Akron, Ohio, have been improved by sheathing with a tough, black cover, which is long-wearing and highly resistant to heat, oil and other enemies of long belt life. Uniform pull and balanced performance results from more consistent coefficient of friction. The belts are available in all standard cross sections and lengths, and are sold in sets.



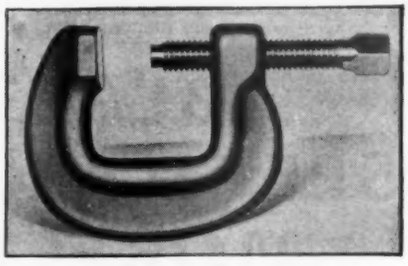
Square D Plug-in Duct Provides Accessible Electric Outlets

Prompt accessibility of electrical outlet when original installations prove inadequate is provided by the Saflex Plug-in Duct produced by the Square D Co., Switch and Panel Div., Detroit, Mich.

This duct is available in capacities of 250, 375, 600, 750, and 1,000 amperes in 2- and 3-wire, single phase, 3-phase and 4-wire service. Each duct will accommodate 12 plug-in units.

Products Engineering Clamp Has 7800 lb. Breaking Point

A high-strength C-clamp with a breaking point of 7,800 lb. is manufactured



by Products Engineering Co., Los Angeles, Calif. This high-breaking point results from a 100 percent drop-forged manufacturing process, including complete heat-treatment of all parts. Screw is square-head type. The clamps are available in 1¼ in. size, and other sizes will be manufactured to order.

NEW MATERIALS

Midland Offers Lead Primer As Replacement for Aluminum

A metal lead primer is offered as a substitute for aluminum paint undercoating by the Midland Paint & Varnish Co., Cleveland, Ohio. The primer is rust-inhibiting, provides protection equal to that of aluminum paint. It may be brushed, sprayed or dipped. It dries hard in four to five hours. The color is neutral gray and will not bleed through the finishing coat.

Detroit Rex Compounds Control Paint and Synthetic Coatings

Control of paint pigments and other ingredients is possible with cleaning compounds offered by the Detroit Rex Products Co., 13005 Hillview Ave., De-

troit, Mich. Triad WS is used with oil base paints or enamels, and Triad WSF is used with synthetic coating. Plugging of the lines, pumps, spray nozzles and eliminators is prevented.

By varying the concentration in the system to suit the particular paint used, paint materials are floated to the top of the supply tank. With this procedure the clean solution is drawn from the bottom of the tank. The paint is removed at periodic intervals. Since effective coagulation is accomplished at low concentration, the difficulty of excessive foaming and the danger of caustic burns are eliminated.

Michigan Chrome Lacquer Simplifies Local Heat-Treating

The handling and grinding operations usually required before heat-treating localized areas are eliminated by a lacquer introduced by the Michigan Chrome and Chemical Co., 6340 E. Jefferson Ave., Detroit, Mich. Customary practice involves copper plating completely steel parts which are to be hardened only in certain areas. The plating is then removed from the portions to be hardened by grinding.

With this new lacquer, a coating is applied on the areas to be hardened before they are plated. After plating, the lacquer is removed and the pieces are ready for heat-treatment. The lacquer is easily applied and removed, and requires no special skill or equipment.

TRADE PUBLICATIONS

BALL BEARINGS New Departure, Division of General Motors, Bristol, Conn., has prepared a new edition of "Interchangeable Ball Bearing for Replacement" in automobiles and machinery.

CHAIN HOISTS Spur-geared chain hoists of ½ to 4 ton capacity are described in a folder distributed by Coffing Hoist Co., Danville, Ill.

CHROMIUM PLATING The uses and advantages of chromium plating are discussed in a 24-page brochure prepared by the Chromium Corp. of America, 120 Broadway, New York, N. Y.

CLUTCH APPLICATION Morse Chain Co., 7601 Central Ave., Detroit, Mich., announces a six-page booklet, No. K-6, covering clutch applications for indexing, free-wheeling and backstop operations. Engineering data is diagrammed and charted.

DIELESS DUPLICATING Metal duplication without dies by means of benders, brakes and shears is described in a 32-page booklet prepared by O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

GAGE STANDARDS A 16-page book on "American Gage Design Standards," containing material compiled from in-

Accuracy is an important qualification in a precision tool—no doubt the most important. But today a machinst deserves a lot more, and he gets it in a Lufkin. In every Lufkin tool you'll find little details that permit you to work faster, with more ease and less chance of error. It's these details and the effect they have on your work that mark the superior quality in tools by Lufkin. Our catalog illustrates and thoroughly describes each of them. Write for your copy.

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formation published by the National Bureau of Standards and the U. S. Department of Commerce, has been issued by the Lincoln Park Tool and Gage Co., Lincoln Park, Mich.

MACHINERY GUARD Sheet metal guards for dangerous machinery installations are discussed in a folder prepared by the Bargar Sheet Metal Co., of 12401 Euclid Ave., Cleveland, Ohio.

MAGNIFIER An illuminated magnifier developed for close inspection of parts is described in a folder by the George Scherr Co., Inc., 128 Lafayette St., New York, N. Y.

MOTOR CONTROLS The manufacture of motors and controls for general industrial use is described in a 32-page catalog announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PORTABLE TOOLS The operations and uses for a portable electric tool are described in a catalog released by the Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago, Ill. The catalog lists accessories and shows several types of operations.

POTENTIOMETERS A catalog-bulletin, No. A-305, of potentiometer temperature indicators and indicating resistance thermometers has been issued by The Foxboro Co., Foxboro, Mass.

PUMPS Engineering data on pumps, including head capacity tables, dimension charts, performance data and engineering recommendations, is included in a 36-page brochure compiled by Allis-Chalmers Mfg. Co., Milwaukee, Wis.

REFRIGERATED WELDING A four-page bulletin describing a process for refrigerated welding has been prepared by the Frostrode Division, Weltonic Corporation, 3001 E. Outer Drive, Detroit, Mich.

RIVET HEATERS Electric Rivet Heaters are described and illustrated in a folder released by American Car & Foundry Co., 30 Church St., New York, N. Y.

SHEAVES Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has prepared a 16-page booklet describing sheaves for variable pitch belt drive.

TAP RECONDITIONING How tap life and efficiency can be increased is described in a four-page illustrated folder released by Detroit Tap & Tool Co., 8432 Butler St., Detroit, Mich.

TECHNICAL BOOKS Barnes & Noble, Inc., Dept. E, Fifth Ave. at 18th St., New York, N. Y., has released Catalog T-7 of technical books.

TOOLROOM MACHINES Hack Machine Co., Des Plaines, Ill., has pre-

TECHNITE
CAPEWELL
HACK SAW BLADES
Win
Records
Cutting
Cast Steel
Given the job of cutting test bars, which contain large amounts of abrasive material, Capewell's Technite blades showed this steel foundry a new record for reduced breakage. Hint:—Test Capewell on your own tough jobs.
THE CAPEWELL MFG. CO.
Hartford, Conn., U. S. A.
CAPEWELL
THE TREND IS TO TECHNITE
THE MOLYBDENUM
HIGH SPEED HACK SAW BLADE

pared a 24-page booklet describing multi-purpose machine tools.

TORCHES Several pumpless blow torches are shown and described by National Safety Device Co., 836 Hubbard St., Chicago, Ill., in an eight-page folder.

TRANSFORMERS United Transformer Co., 150 Varick St., New York, N. Y., has prepared a 36-page catalog of transformer equipment.

TRANSFORMERS Secondary network transformers for industrial use are described in a bulletin released by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Systems covered are overhead, spot, vertical and industrial networks.

TUBE DATA Babcock & Wilcox Tube Co., Beaver Falls, Pa. has prepared technical data card showng tolerances for seamless tubing.

VICTORY PRODUCTS An illustrated booklet showing its products and their contribution to the Victory Program has been prepared by the Ex-Cell-O Corporation, Detroit, Mich.

WHEEL DRESSING Dressing of grinding wheels is described in a folder prepared by Wheel Trueing Tool Co., 3202 W. Davison St., Detroit, Mich.

NEW BOOKS

MANUAL OF INSTRUCTION IN WELDING AND CUTTING—*By Boniface E. Rossi, director of welding division, The Delehanty Institute. Ring binding. 99 pages. Published by McGraw-Hill Book Company, 330 West 42 St., New York, $1.*

This is a "how" book. While a brief discussion is given to the theoretical principles underlying each type of weld, the objective here is to train young men in the manual operation of arc welding and oxyacetylene welding and cutting equipment. It is recommended that for a fuller understanding of the welding process, this manual be supplemented by other reading.

It is not claimed that a man can be made a welder by reading a book. However, books like this, that give practical exercises in welding technique, are of great help in learning the trade, especially when welding equipment is available to the reader.

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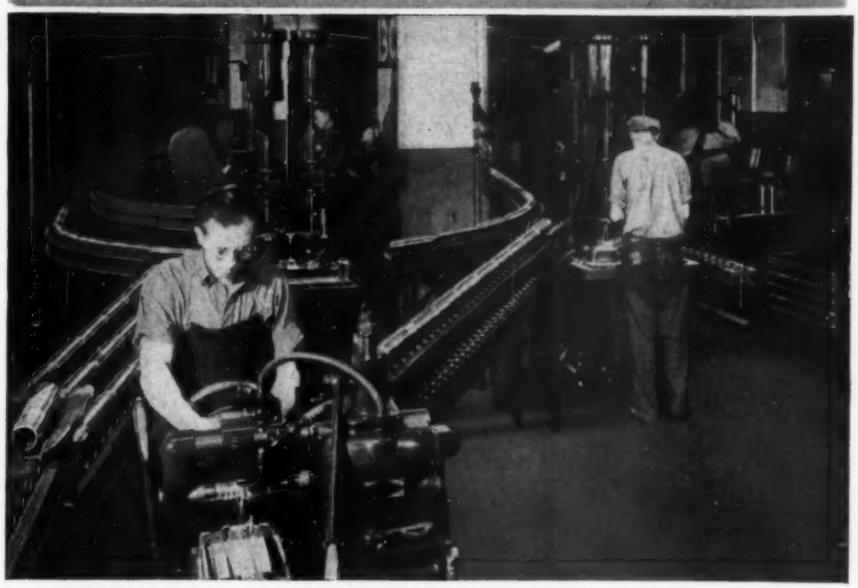
WORKSHOP SENSE—*By W. A. J. Chapman, Head of the Engineering Department, County Technical College, Wednesbury, England. 58 pages. Published by Longmans, Green & Company, 55 Fifth Ave., New York, N. Y. 60 cents.*

Written especially for the new worker in munition plants and other produc-

STANDARD CONVEYORS
. . . VITAL "SUPPLY LINES"
TO PRODUCTION MACHINES



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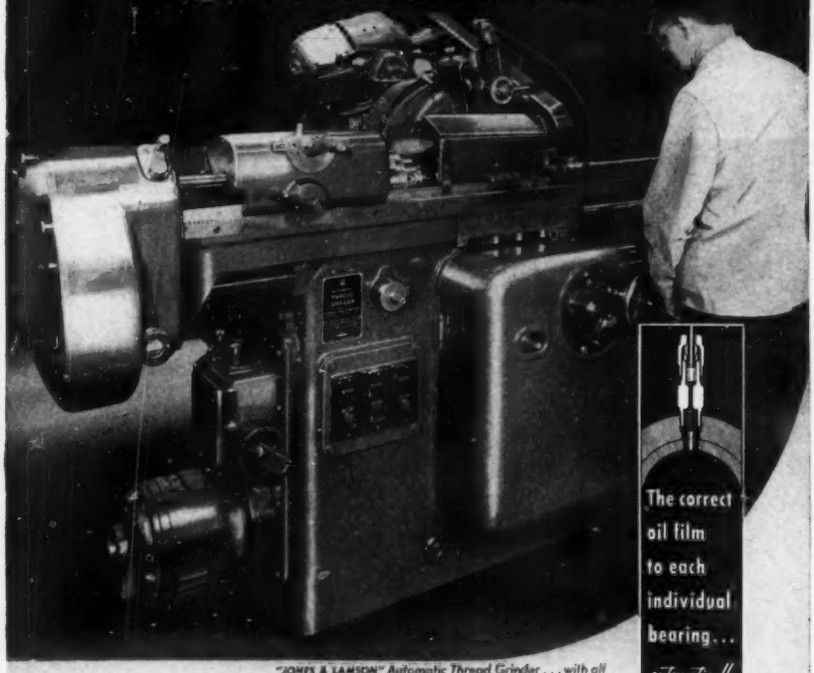

"JONES & LAMSON" Automatic Thread Grinder . . . with all bearings except grinding wheel spindle Bijur-lubricated.

● No time is lost from productive work . . . a BIJUR-equipped machine oils itself, while running! Metered oil-feed—the correct oil-film needed by each individual bearing—is supplied automatically. The efficiency of operator and machine is raised . . . precision standards are held . . . maintenance is reduced to a minimum . . . production stepped up!

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tive industries, this volume discusses in a general way the organization of an industrial plant, and covers in detail the problems of personal safety and the care of machines and equipment. Materials used in industry and forming processes involved in the production of parts from these materials are discussed briefly in order that the new worker may have a broad view of the problems involved in industry. In addition, another chapter discusses the requirements for accuracy in mass production operations, and describes gaging methods as well as the use of automatic stops on machine tools.

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MACHINE SHOP MATHEMATICS—*By Aron Axelrod, teacher of machine shop mathematics and science, The Bayonne Vocational and Technical High School. 368 pages. Published by the McGraw-Hill Book Company, 330 West 42 St., New York.* $2.50.

This volume presupposes that the reader has a fundamental knowledge of mathematics and devotes itself to the application of mathematics to machine shop practice. It is especially designed for apprentices, trade school students and others new to the machine shop field, or those who seek to brush up on the subject.

Since measurement forms the outstanding application of mathematics to shop work, this subject is given first attention. Other topics covered are geometric construction, graphical charts, shop trigonometry, belting, speeds and feeds, gears, lathe work and milling machine work.

An appendix contains a number of useful mathematical tables and a review of algebra for the student who may need it. In accordance with standard textbook practice, a number of problems follow each chapter. The author has included a few problems that are impossible of solution in order to test the student's ability to recognize them when they are encountered in his studies.

•

DIMENSIONAL CONTROL—*Prepared by the Sheffield Staff in collaboration with W. Wilson Burden. 64 pages. Published by the Sheffield Corporation. Dayton, Ohio.* $1.50.

Devoted to the design and the use of gages required for interchangeable manufacture of metal products, this book opens with a resumé of the history of standards in gaging and goes into some detail on early English and American standards. The basic reasons for precision manufacturing, the fundamentals of gaging practices, size comparisons, and types of gages are explained.

Such topics as wear allowances, gage finish, bilateral and unilateral tolerances, gagemaker's tolerances and fits are discussed. The theory and practical

use of "go" and "not go" gages and gage blocks are illustrated. There also is a comprehensive explanation of selective assembly and interchangeability.

An insert gives wear allowance and gagemaker's tolerances for plain plug and ring inspection gages. It also includes gagemaker's tolerances for flush-pin and adjustable snap gages. The material is presented so it will be understandable to students and useful to experienced inspectors.

•

HOW TO PREPARE A FOREMAN'S POLICY MANUAL—*By R. C. Oberdahn, director of Training, Calco Chemical Division, American Cyanamid Company. Loose-leaf binding. Published by National Foremen's Institute, Inc., Deep River, Conn.* $6.50.

Good plant managers have never underestimated the part played by the foreman in a well run plant. Today, with thousands of new men entering industry, the foreman's key position becomes more pronounced than ever.

Unfortunately, the foreman has received too little help from management regarding the proper conduct of his job. If he is a good foreman, he knows his men and his tools and how to organize both for maximum results. But he should know more than this—something about the company as a whole and just where he fits into the larger picture of the organization.

This book is designed to fill such a need. It is divided into three sections: the foreman's job, legislation and company policies.

While this book forms a manual in itself, it is presented with the idea that it will serve primarily as a guide for other manuals compiled with the same objective in view.

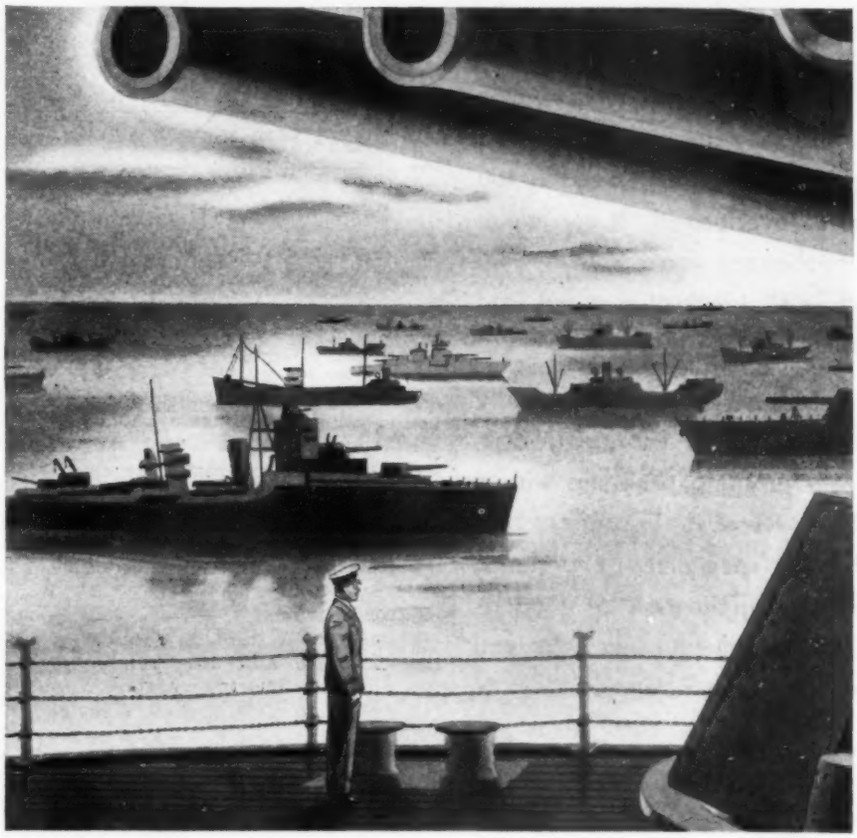
•

MILLING MACHINE INDEXING—*By C. A. Felker, personnel director, Marion Steam Shovel Company, and H. W. Paine, professor of vocational education, University of Toledo.* 88 *pages. Published by the Bruce Publishing Company,* 540 *N. Milwaukee St., Milwaukee, Wis.* $1.50.

Indexing covers an extensive and varied field, as far as its applications are concerned, and the subject has been treated only in a fragmentary manner by almost all texts on shop mathematics and by most handbooks dealing with the subject of machine mathematics. In this book, which is devoted solely to simple, differential, block, and compound indexing, the authors have given this subject more thorough treatment than has been attempted heretofore. Explanations and sample problems showing the best fields of application of each type of indexing are incorporated in the text. In addition to the mathematical procedure involved, the authors have presented enough trade informa-

Blockades aren't Limited to the Seven Seas.

● The most serious blockades in America's war effort today are those occurring in the great plants producing war materials. Delay in getting parts and assemblies from one machine to the next, and the lack of a definite production pace tieing together all departments, is keeping production down. Mathews engineering hours are devoted entirely to the solution of these problems. Mathews Conveyers are breaking these blockades by speeding materials from one machine to the next, through inspection and into cars or ships. The success of our production depends upon our keeping materials moving. Mathews Conveyers are moving them.



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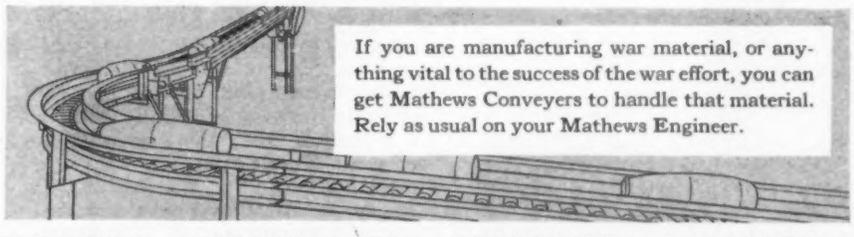

If you are manufacturing war material, or anything vital to the success of the war effort, you can get Mathews Conveyers to handle that material. Rely as usual on your Mathews Engineer.

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tion regarding indexing attachments, so that the operation and construction of the various available types can be understood.

Designed for use either as a machinist's reference book, or as a classroom text for the upper grades of vocational or technical high schools, or for apprentice and employee training classes and college engineering machine-shop classes, the text has been arranged, so that each chapter first presents the necessary trade information concerning indexing attachments, and the set-up being studied. This is followed by explanations and sample problems regarding the different applications.

Each method of indexing is handled in a separate section, independent of discussions of other methods. Furthermore, the material in each part is arranged in pedagogical sequence of difficulty in so far as possible, and the sections themselves are arranged in order of frequency of use by the mechanic. Photographs, drawings and tables are incorporated in each section, so that the explanations may be thoroughly understood.

TO THE EDITOR

Boon-Doggling With Teeth

Dear Sir:

The article "Gear Tooth Measurement" by C. A. Young (*AM*—Vol. 86, page 278) should have been written by the W.P.A.; then we could have said "boon-doggling"!

Why does Mr. Young insist on using tooth calipers and making additional calculations? We can find no reasonable reason for going beyond the "over-pin" calculation and using micrometers (they can be used while cutting the gear). Why the extra mathematical effort in order to balance tooth calipers on a T which is balanced on pins?

I guess we'll stick by Prof. Buckingham and measure over pins.

Very truly yours,

R. S. WRIGHT

How to Conserve Rubber Hose

Careful application of these suggestions will enable users of industrial rubber hose to help in the conservation of rubber and at the same time to effect operational savings:

Make an effort to get the correct hose for the job. Sometimes there is a temptation to order hose with several more plies than are recommended, with the idea that this will provide a safety factor and increase service life. Often the reverse is true; the hose will be harder to handle and may have a shorter life.

Try to use the proper type and size of coupling or clamps. Avoid ordering special hose with rigid tolerances. The

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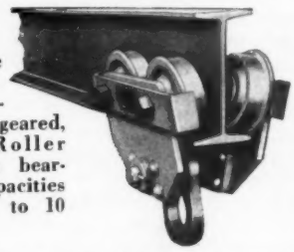
Available in 250-, 500- and 1000-Lb. capacities beginning at $139.50. Adapted to hook, bolt and trolley suspension. Features include Double Drum Construction, Electric Brake, Limit Switch, Push Button Control. Simple, heavy construction—employing ony two gear reductions—your assurance of long, trouble-free service.

CONCO I-BEAM TROLLEYS



Available in four models—plain or geared, Hyatt Roller or plain bearings. Capacities from ¼ to 10 ton.

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Differential model shown is ideal light-weight, low-cost hoist. Easily operated; holds load at any point. Sturdily constructed. Priced to pay a profit even on occasional use.

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A speedy, heavily built hoist in capacities from ¼ ton through 20 tons. Features safety load chain guide; dust-proof, oil-tight gear cover; electrically welded chain. Perfect mate to the Conco I-Beam Trolley.

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GRINDING THE WAY TO VICTORY

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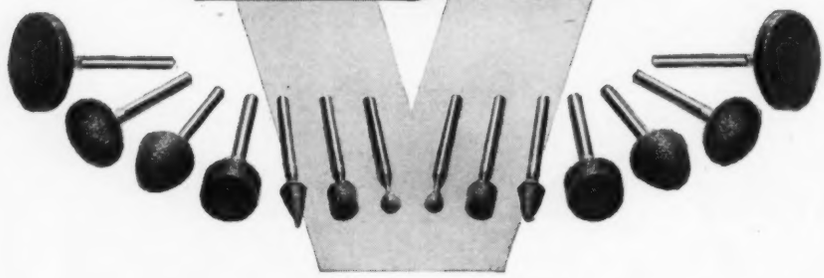
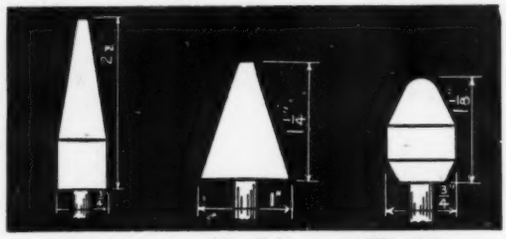


Speed and Smoothness in cutting action—Longer Life—that's what you get when you use Chicago Mounted Wheels.

Made in all types of abrasives, grains and grades, mounted on shanks of different diameters and lengths — there is a Chicago Mounted Wheel to lick every grinding job from the most intricate cartridge dies to snagging hard-to-reach parts on tanks. For high-speed POLISHING, the sensational new Chicago Soft Rubber Mounted Wheels save hours of tedious hand work.

Illustrated is a group of wheels mounted on ¼" diameter shanks, for use with portable and precision equipment. These are one-half actual size. Hundreds of other shapes are available on 3/32", 1/8" and 3/16" diameter mandrels.



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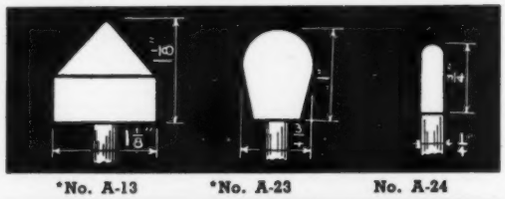

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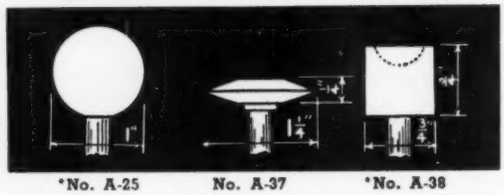

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* This shape also available in Soft Rubber Polishing Bond

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The 3-pound grinder with perfect balance—a real he-man production tool that is saving hundreds of hours in our national war effort. Ample power to drive a 2½" diam. wheel. 17,000 r.p.m. Encased with 3 Chicago Mounted Wheels, Drum Sander and Bands, extra Collets, Wrenches, Dressing Stone, $38.50.

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First and finest. Wt. 12 oz. Uses 300 accessories to grind, drill, polish, cut, rout, carve, sand, saw, sharpen, engrave. Plugs in any AC or DC socket. Speed: 25,000 r.p.m. $18.50 with 7 Accessories.

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size of fitting or attachment can usually be changed to fit standard hose. This will save trouble, delay and expense every time the hose is changed.

New hose can be destroyed by bending in a small arc close to the fitting. Large heavy hose can be saved this ordeal by a sling or careful support. Smaller hose can be treated with a "whip end." This is a short piece of hose coupled at both ends and inserted in the line at any point where severe strain or abrasion exists. The whip end takes the punishment and can easily be replaced, while the longer sections are permitted to render maximum service life.

Like all rubber products, hose is best stored in a place away from the sunlight, heat and ozone. The storeroom should be removed from generators, electric motors, boilers and steam pipes. Hose with fabric covers will mildew if kept in damp, musty places. Always coil hose on a floor, if it is dry, or on a shelf or other flat surface. Never hang hose on nails, hooks, or brackets.

Never shut off the flow in a hose by kinking. All couplings should be carefully inspected before installation to see that burrs, serrations, gyrations and other sharp edges are not present. If they are, they should be carefully smoothed off with a file.

If couplings are tight fitting, soap or rubber cement may be used as safe lubricants. Never use grease, and never ream out the hose to accommodate the fittings. Place the coupling in a vise and force the hose straight over the sleeve. Never drive the coupling in with a mallet or hammer.

Abstracted from a paper by K. B. Christie, production manager, Hose Department, United States Rubber Company.

Progress of Machine Electrification

At the beginning of the twentieth century an electric motor was seldom used as a means for direct drive on machine tools. Instead, gas engines, steam engines, or electric motors were used to drive a countershaft, which in turn drove the machine tools. The transmission of power was accomplished by belts, chains or ropes. Therefore, the location of the machines was definitely determined, and any change in their positions meant moving the countershaft. This, combined with the upkeep of belts, meant considerable expense, time and care.

The development of the individually driven machine tool, depending for power on a motor or motors mounted somewhere on or in the machine was a great improvement, as the machine could be moved completely, power and all, depending only on the electric power lines. Today, with almost every industry expanding their plants and repositioning equipment, there would be much valuable time lost if machine tools still were driven from line shafts.

In the early days of individually driven machine tools, the motor was mounted in any place or any position that was convenient to drive the machine. This caused a variation in the size and shape of motors of identical horsepower, speed and cycle. As the direct drive with gear changing became more popular, these variations became a handicap, both to the machine tool manufacturers and to industry. The machine tool builder had to design his machine to accept all different makes of motors, or to build a standard machine using but one make of motor.

This problem was solved by the standardization of motor frame dimensions. The Nema standard for motors was one of the most welcome contributions of the motor manufacturers to the machine tool industry. It helped the machine tool manufacturers because they could design their machines to accept any make of motor the customer desired. It also helped industry because one motor could be stocked for maintenance on many machines of various makes.

A problem that so far has not been solved is the variation of control equipment. Controls purchased from any two different electrical manufacturers will do the same thing electrically, but mechanically we still have the troubles we had with motors before they were standardized. It would be a great improvement if we could interchange control equipment of one make with that of another, as we do with motors, so that regardless of what make of control the customer preferred, the machine could be designed to receive it.

Another bottleneck to production is the various voltages, phases and cycles used in power systems of different plants. It would speed production if the machine tool manufacturer had only to purchase equipment for 220 or 440 volts, three phase, 50 or 60 cycle, and the electrical manufacturer had only to build equipment for the same. Instead, we have to purchase, and the electrical manufacturer has to make equipment for 110, 208, 220, 380, 415, 440 and 550 volts, single phase, two phase four wire, two phase three wire, and three phase, 25, 30, 40, 50 and 60 cycle. The combinations obtained from these different voltages, phases and cycles amount to many hundreds.

Of course, in the present rush this condition cannot be overcome, but it seems that new plants being built for war production should have a standard power system, then after we win this war a standardization of power systems could be accomplished.

Another bottleneck in the production of machine tools, when they are so vitally needed, are certain electrical specifications. In one case production on machine tools was held up for months because the specifications called for certain mechanical and electrical drawings from the electrical manufacturer, which had to be drawn up especially for the customer. The electrical manufacturer tried to supply

1/12 FORMER TIME with DoAll BAND SAWS

These 8" diam. Cutters for a Wood Shaper were made at Hodges Tool & Mfg. Company. The left Cutter made from 7/8" tool steel was formerly cut on a miller with 3 cuts per tooth in 6 hours. With a DoAll Saw, the job took only 29 minutes. The right Cutter from 1/2" tool steel which formerly required 4 1/2 hours on the miller was cut with a DoAll saw in 21 minutes.

This is only one of many case records showing unprecedented savings of time and material when using DoAll Band Saws—the saws that you need today to push forward your share of the huge national production job camping on the doorstep.

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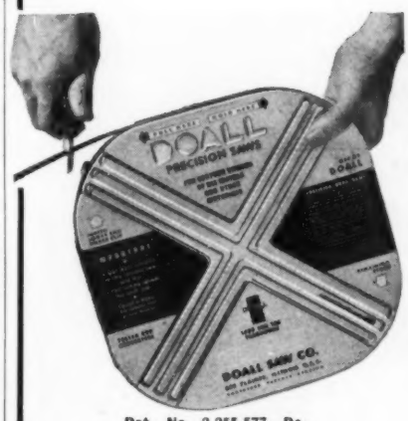
DoAll Band Saws come in 42 tempers, pitches and sizes, to cut everything from hardest high carbon steel to soft brass. Each metal box contains a 100-ft. coil, with size and style saw plainly marked.



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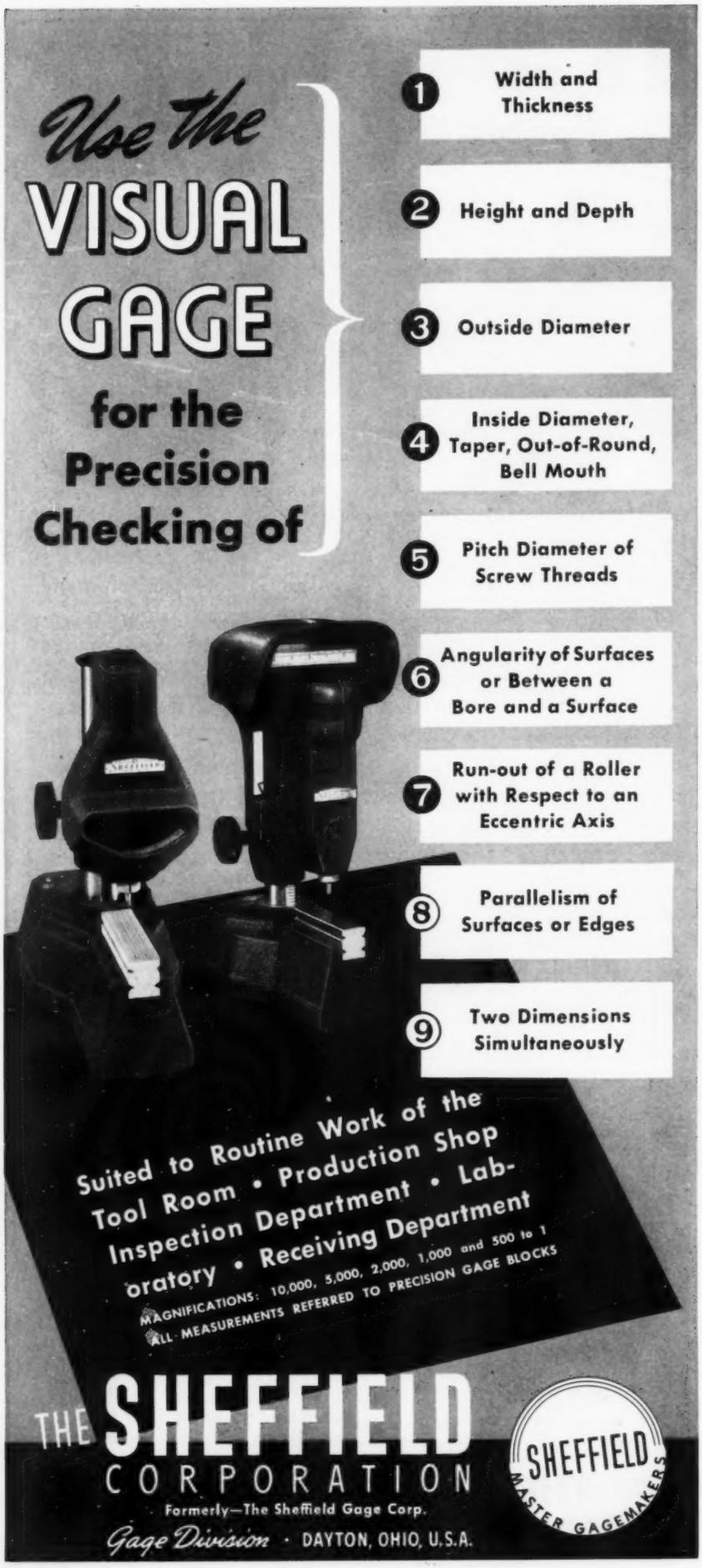
Use the VISUAL GAGE for the Precision Checking of
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the usual drawings which they had on hand for maintenance on the equipment, but these drawings were not approved. If the purchaser of a machine tool would designate the machine he needs and leave it up to the machine tool manufacturer to make such a machine, both electrically and mechanically, he would receive a satisfactory tool at an earlier date, doing away with red tape and specifications which tend to retard the increased production needed today.

In looking into the future of machine tools, I believe there will be developed, by combining the unlimited possibilities of electricity with improved mechanical design and faster cutting tools, a machine that will produce many times the quantity and quality of work produced on what is called a modern machine tool today. The variable speed direct current motor will be used to a greater extent, replacing the use of gear changing, both for moving the tool and in driving the part being machined. By the use of electronics, machines will become more automatic and will produce more accurate work by not leaving the precision of the work to the machine operator.

Abstracted from a talk by C. E. Greene, Monarch Machine Tool Company, at the Machine Tool Electrification Forum sponsored by Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Salvaging Scrap for Victory

There is a new slant today on the necessity of keeping scrap losses down. Before priorities, salvage was entirely on a cost basis. The amount of money saved decided how much was to be spent on salvage. Now, it's different. Cost, in many cases, is held secondary. Conservation of materials is a matter of self-preservation. In all Westinghouse plants we have consistently hammered the point home that our very jobs depend on efficient use of time, materials, and tools.

The organization of a plan to conserve and reclaim materials starts with design and ends with the disposition of the scrap. The engineer should design around accepted material standards and sizes to eliminate short ends. Scarce and critical materials must be avoided wherever possible. He must check his design to eliminate extra thicknesses and excessive weights.

Naturally, the more types and sizes of product, the greater the problems. Sales, engineering and manufacturing executives should be continually studying the possibilities of reducing these in the interest of standardization. It is possible to make more of a fewer number of types and sizes with much less investment in materials and machines. In addition, it is possible to train new employees more quickly and eliminate waste time and motion. It is no secret that the military strength of the axis

powers comes from the establishment of a minimum of types and sizes in everything, and then concentration on producing those standards.

There are tremendous possibilities in the field of reclamation. The first function of a salvage program is to prevent scrap, and here is where the salvage head can make his salary many times over. The application depends largely on the individual problem and quantities involved, but large or small, every plant can use part of the program.

When short ends of sheets, plates and bars are used to make smaller pieces, the gain is equivalent to the difference between the costs of good and scrap material. When lumber is burned and at the same time new lumber is brought for shipping and packing, the loss is obvious. When old paper, instead of excelsior, is used for packing, a definite gain is made.

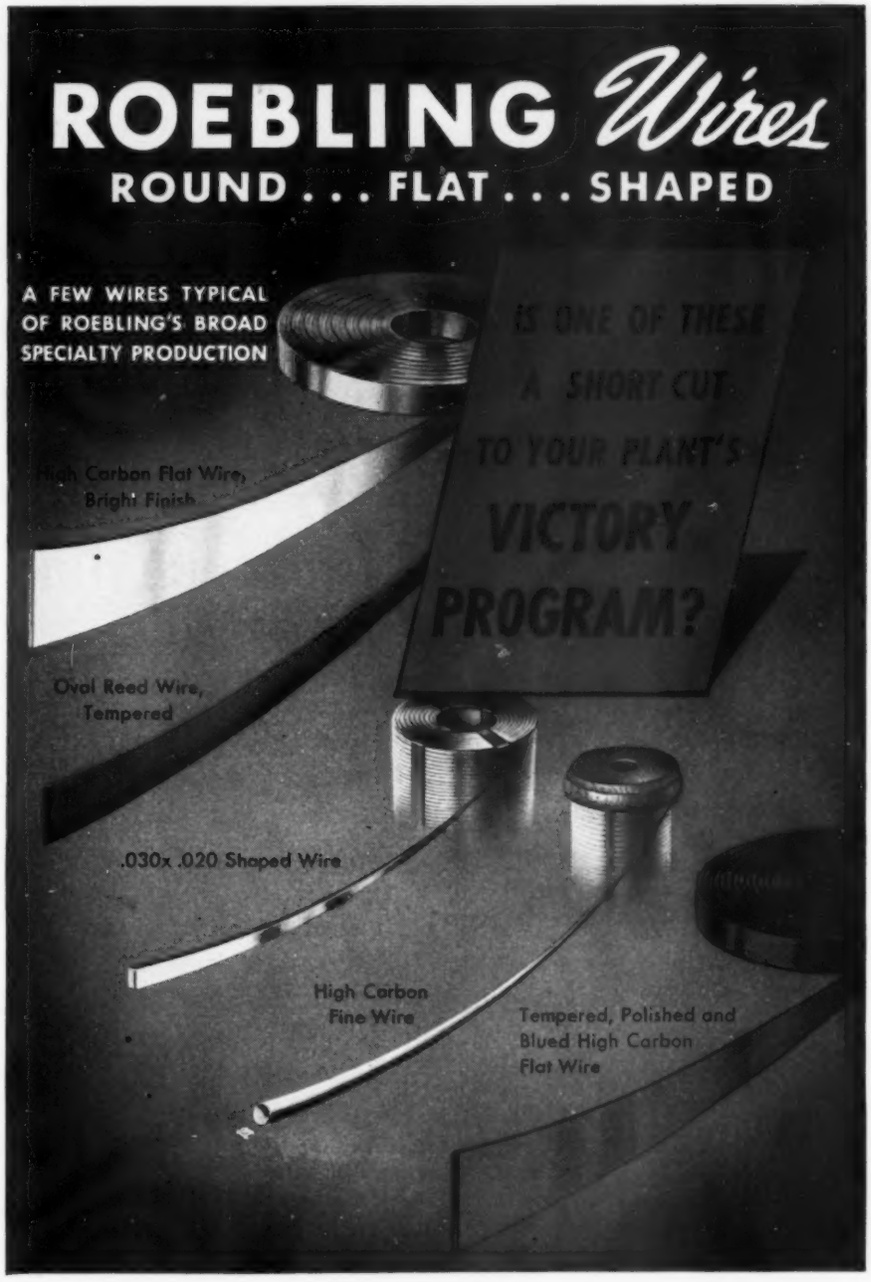
When using any great quantity of oils, paints and varnishes, it is possible to reclaim by simple and inexpensive means a good part of the waste. The loss of paint in spray booths is considerable. There are simple, inexpensive ways to trap this waste and convert the sludge into usable material.

When a study of the scrap received in the salvage department shows a high percentage of the same spoiled parts, the head of the manufacturing department, if advised, can often change some method to minimize the spoilage. Often tools are wasted by improper use; wrong methods of cutting are employed. The problem is reflected in the kind of scrap received, and is always brought to the attention of those who can correct the condition. Today, we can sum the problem of reclamation up in the axiom, "Never scrap anything from which some useful thing can be made."

In disposing of scrap, carelessness or ignorance is responsible for some real losses; superior grades of scrap are often mixed with inferior grades. Tossed out on the trash pile a little at a time, the amount of waste doesn't look like much. But once an effort is made to accumulate the desirable grades, it soon becomes evident how much can be saved. Segregation of certain kinds of scrap usually can begin at the machines where the scrap is produced.

The importance of the workmen's cooperation in the salvage program should be emphasized. Production workers have little, if any, awareness of the value of metals they work with. The foreman's job is to make workers salvake-conscious, and when foremen are thoroughly instructed and sold on the value of a salvage program, they become good missionaries to their workmen. In our company, the suggestion system is used with good effect.

Abstracted from a talk presented at the Celeveland Chamber of Commerce, on March 24, 1942, by Ray Schmidt, supervisor, reclamation and salvage departments, Westinghouse Electric & Manufacturing Company.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A FEW WIRES TYPICAL OF ROEBLING'S BROAD SPECIALTY PRODUCTION
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Production for Offense involves many a problem, not the least of which may be your requirements of special round, flat or shaped wires to exacting standards of steel analysis, dimensions and finish. Gain time by letting Roebling solve these problems for you . . . delivering the right wire . . . to the right standards . . . on schedule.

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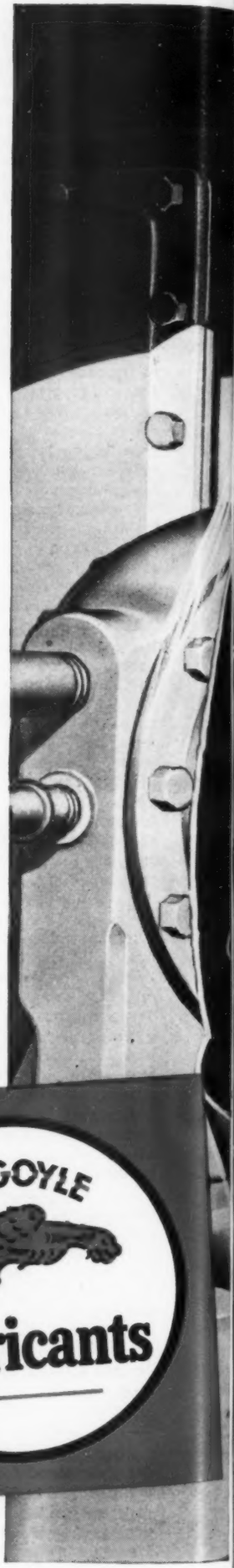
BE SURE YOUR HYDRAULIC FLUID HAS THESE IMPORTANT QUALITIES:

Problem: This hydraulic coupling works like an electric fan blowing into, and spinning, the blades of a disconnected fan. The right half of the bladed shell sets up a current of oil which propels the driven half with a smooth flow of power. Speed is governed by the amount of oil pumped into the shell.

But what happens to the oil? It is whipped and churned into a violent whirlpool. It gets hot. It is mixed intimately with air. Unless the oil is specially made to resist oxidation under these conditions, it will form deposits which might clog the pump and result in sluggish hydraulic action.

Answer: *Gargoyle Vacuoline Oils* were created specifically to meet this problem in hydraulic systems. These oils have been tested thoroughly in actual shop service. They have proved that they possess a remarkable combination of stability and lubricity. Today, these oils are setting new records for reliability on hundreds of war production jobs in *every* field of industry.



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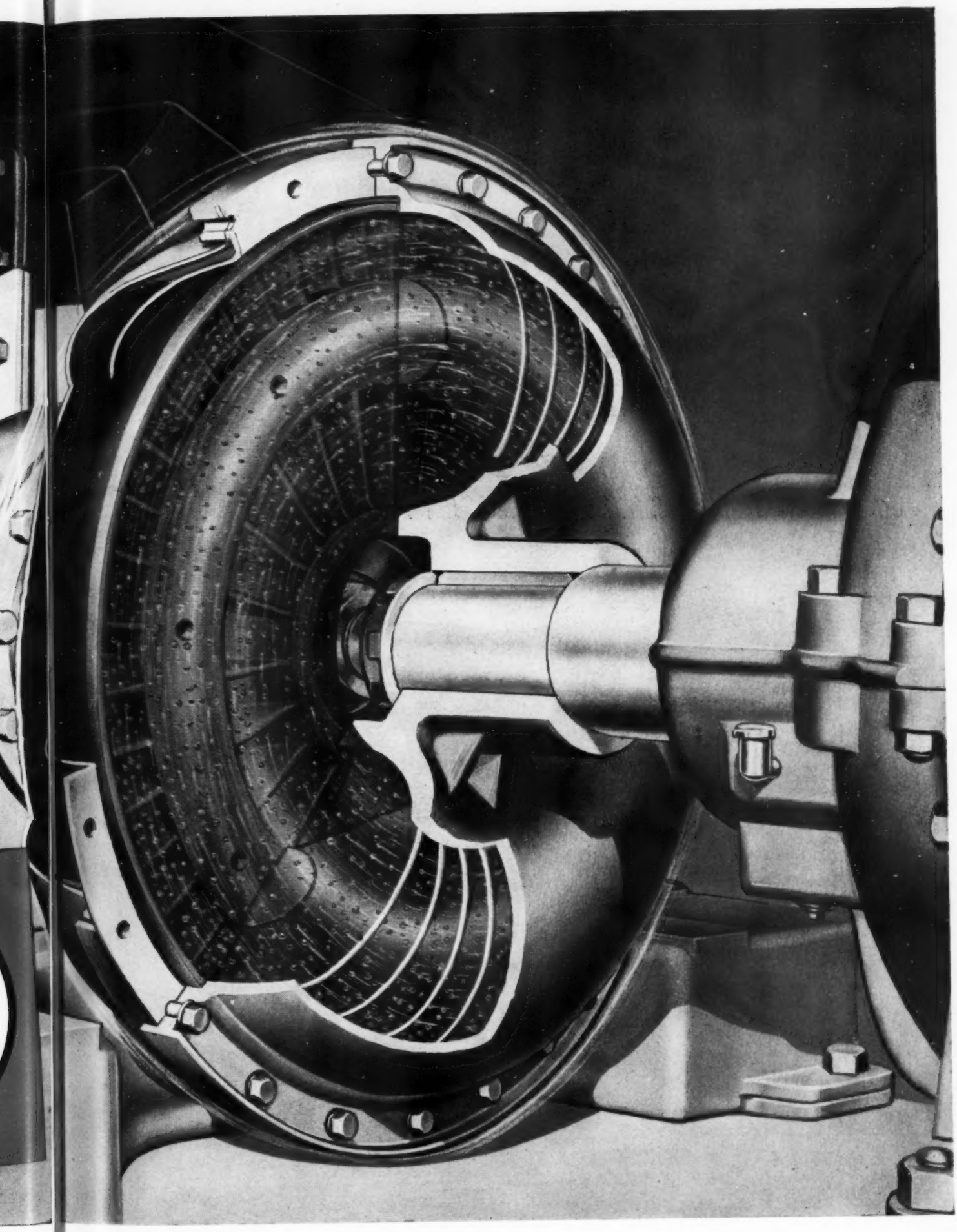


One Hand Driving • Power Tools • Tighter Assembly = 50% Less Assembly Time with Phillips Screws

B. P. (Before Phillips). Slow-driving slotted screws required two hands to aim the screw and steady the work — and still accidents happened, causing plenty of mangled fingers or scars in the work. Always something going wrong — crooked screws — heads splitting — burrs to remove — loose assemblies. Thank goodness those days are gone forever!

A. P. (After Phillips). Faster-driving Phillips Recessed Head Screws need only one hand . . . the other hand is free for support. No fumbled screws — straight, effortless driving. Even when assembling parts already finished — like enameled, painted or other easily-scratched surfaces — power driving is safe, because there's no danger of driver slippage. And screws can be set up tight without heads splitting or raising burrs.

Your assembly crew will find it "easy as rolling off a log" to produce better work . . . in half the time . . . at a 50% cost saving with Phillips Screws.

For facts and screws write any firm listed below.

PHILLIPS RECESSED HEAD SCREWS

GIVE YOU 2 for 1 (SPEED AT LOWER COST)

WOOD SCREWS • MACHINE SCREWS • SHEET METAL SCREWS • STOVE BOLTS • SPECIAL THREAD-CUTTING SCREWS • SCREWS WITH LOCK WASHERS

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterbury, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

PRODUCTION BATTLES ARE WON OR LOST

ON THIS FRONT

● ARE your cutting oils and coolants fitted to the new jobs? Do they meet the new demands for speed and accuracy in war material production? Many factors can make or break machine production schedules, but none is more important than cutting oil.

Let a Standard Oil Engineer examine some of your machining operations. Try the cutting oil or coolant he recommends. It's a simple way to get every minute of much needed production from your present equipment. You can reach one of these Engineers by writing Standard Oil Company (Ind.), 910 S. Michigan Ave., Chicago, Ill.

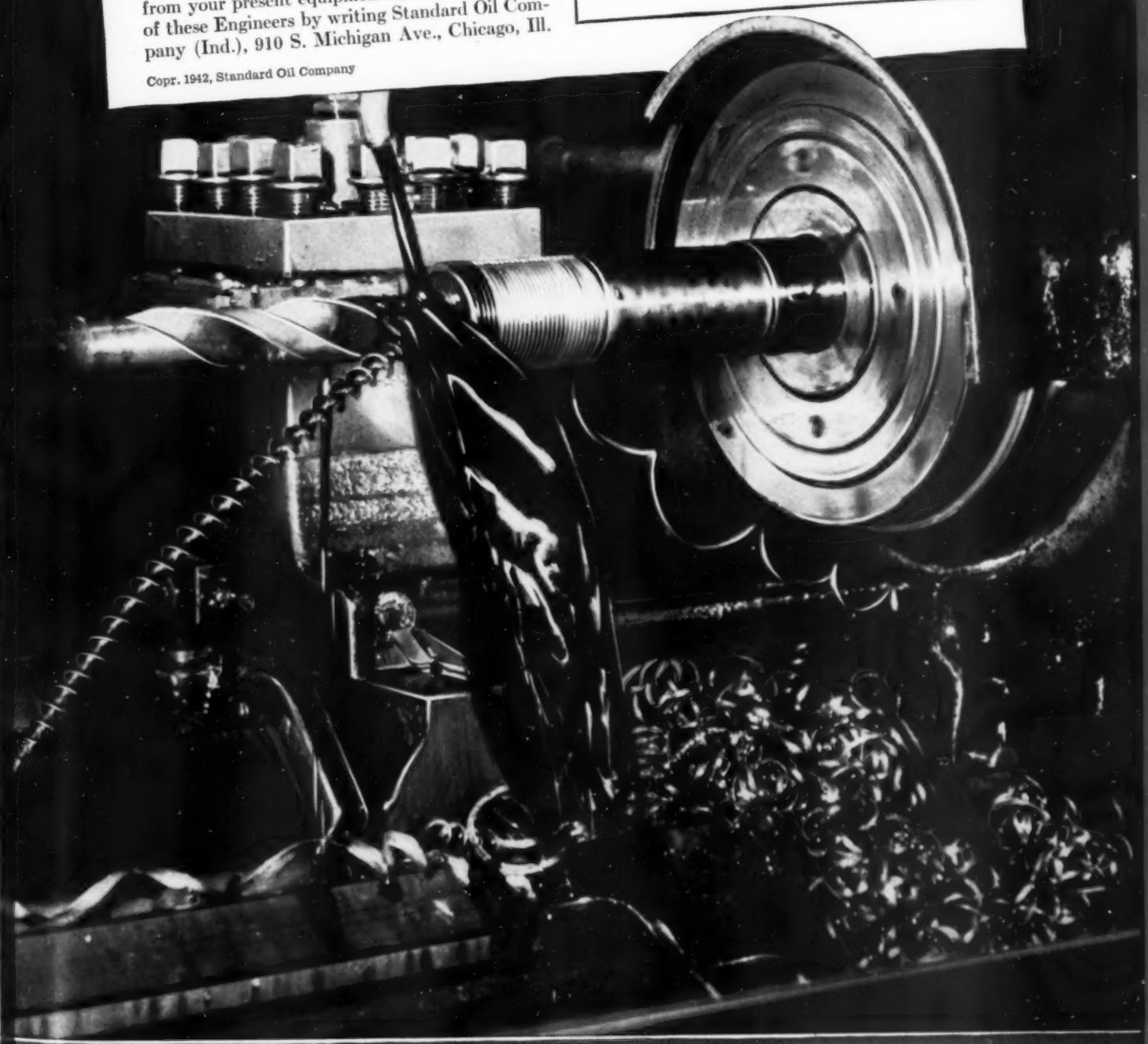
Copr. 1942, Standard Oil Company

Consider the many ways in which a better cutting oil or coolant can affect machine production:

● Even a slight improvement in tool life will add hours of productive machine time by reducing down-time for changing tools.

● Sharper tools give finer work finishes and greater accuracy — fewer parts are rejected by inspectors.

● Lost machine time for cleaning oil lines is eliminated.

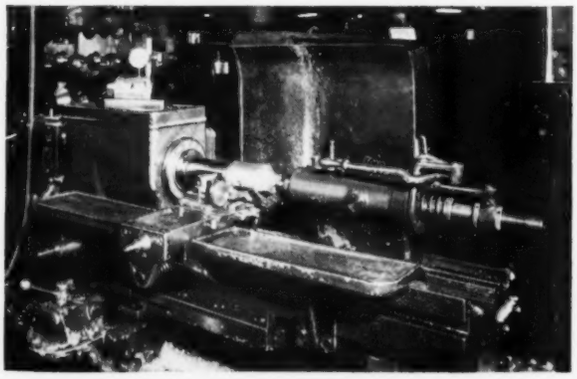


STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION

..LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATIO

REDUCE DISASTROUS DELAYS . . . IMPROVE MACHINE LUBRICATION



PROTECT MACHINE TOOL BEARINGS WITH SUPERLA GREASE

Bearing failures were practically eliminated, maintenance costs were materially reduced, and, because of reduced consumption, grease costs were actually lower with Superla Grease. That was the experience of a Michigan auto parts manufacturer when he took the suggestion of a Standard Oil Engineer and put Superla in all plain sleeve and anti-friction bearings on his machine tools. Ordinary cup greases had given considerable trouble. Bearing replacements were frequent. Superla more than paid its way in the saving in machine time alone.

LET A STANDARD OIL ENGINEER HELP YOU

Full 24-hour operation—little time to make inspections—maintenance on a catch-as-catch-can basis—no wonder machines are laid up for part replacements.

It's tough, but there is a solution. Take an inventory—find out how your lubricating needs have been changed by new demands on your equipment. Lubricants that gave excellent service under normal operation may be entirely inadequate today. Make sure that each oil or grease is exactly fitted for the job it has to do now.

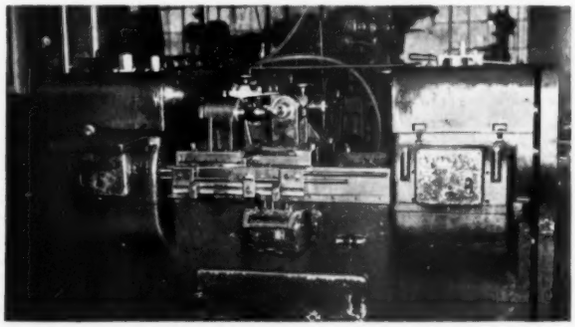
If that seems like a large order, with your time already fully occupied, get a Standard Oil Engineer's help.

He'll have up-to-the-minute information on new lubricants developed to meet the new demands. His recommendations will save time spent experimenting with products and lubricating schedules. But let one of these Engineers himself explain just what he does. Write Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago, Ill., for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

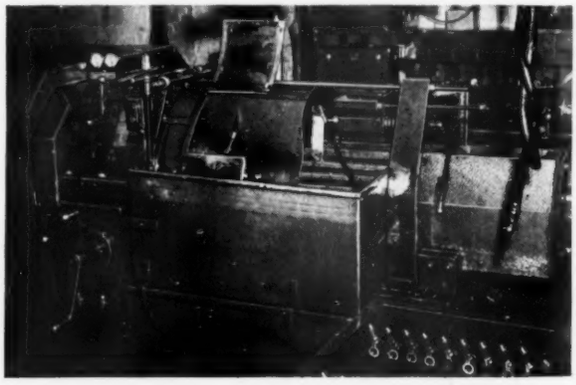
ONE OIL FOR INDOIL CIRCULATING SYSTEMS . . . HYDRAULIC MECHANISMS . . . GEAR CASES . . . ON ALL THESE MACHINE TOOLS

Like any typical metal working plant, a Michigan manufacturer had many types of grinders, lathes, automatics, etc. He also had the problem of stocking all the lubricants recommended for the various machines and the more serious problem of making sure that each machine was lubricated with the right product.

When a Standard Oil Engineer was called in to recommend a hydraulic oil for a new boring machine, he suggested the same oil—Indoil—be tested on other equipment.

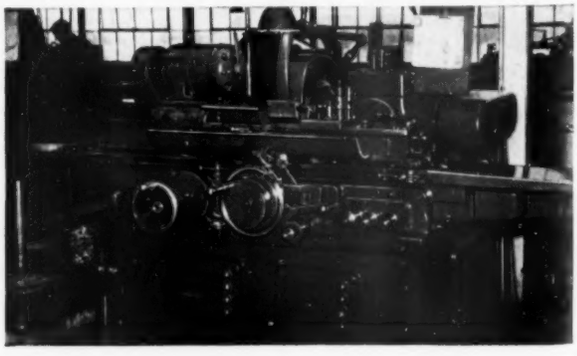


The quality of Indoil for this multi-purpose use was so apparent that it is now used in both the hydraulic systems and gear cases on the boring machine (above) and a six-spindle automatic (below).



It is used in the circulating system that lubricates all spindles in a traverse grinder (at bottom) and also on a centerless grinder oil system, lubricating both bearings and spindles.

Two grades of Indoil handle all these jobs—reducing stock, lubricating time, and the possibility of errors.



OIL IS AMMUNITION USE IT WISELY

Masonite* Die Stock

ACCURATE, DURABLE, PERMANENT

WIDELY used by aircraft builders in the manufacture of dies and fixtures for processing sheet metal, Masonite Die Stock also makes an accurate work surface for the assembling of bulkhead fixtures.

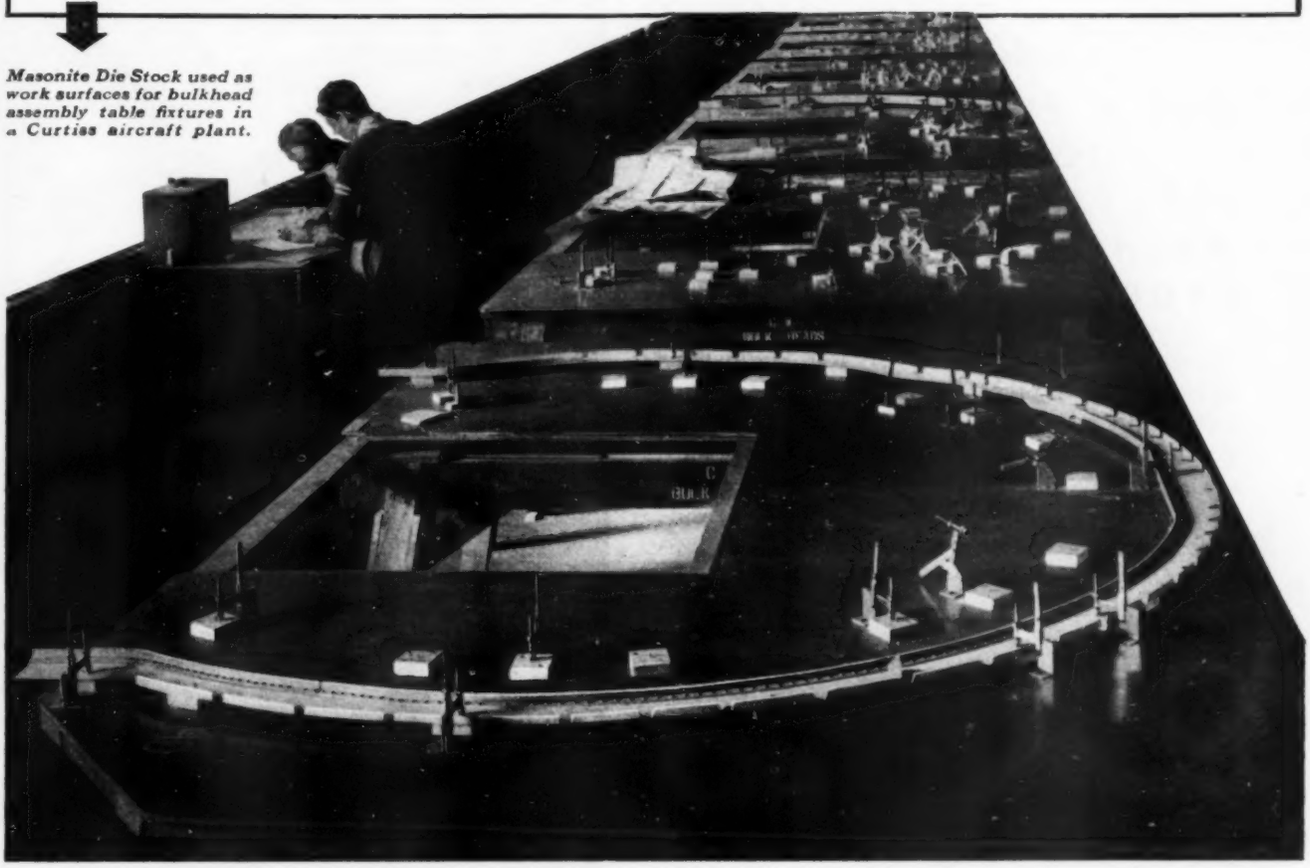
This smooth, durable material combines light weight with great strength, gives long service at low cost. It can be drilled, tapped, and will stand abrasion. Fixtures can be moved easily.

A highly moisture-resistant material without the grain of natural wood, Masonite Die Stock has inert qualities similar to metals, yet can be installed with wood-working equipment.

While its most spectacular success is being demonstrated in the aircraft industry today, Masonite Die Stock is also being used by other manufacturers where accuracy, durability and permanence are required.

Masonite Die Stock is available in thicknesses of ¼ to 2 inches . . . in sizes of 48 x 72 inches and 48 x 144 inches. For further details, fill out and mail coupon below.

Masonite Die Stock used as work surfaces for bulkhead assembly table fixtures in a Curtiss aircraft plant.



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MASONITE CORPORATION *Dept. AM-5,* 111 W. Washington St., Chicago, Ill.

Please send me illustrated literature and complete information about the new Masonite Die Stock.

Name and firm _____

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• • •

The illustrations on this page show portions of some of the drafting rooms and the blueprint department operated by Special Engineering Service, Inc. Full size layouts of large assemblies can be handled with ease on 8 by 16 feet boards, two of which are shown in the background of the top photograph.

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KEEP WHEELS TURNING *FASTER···LONGER*

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Call your
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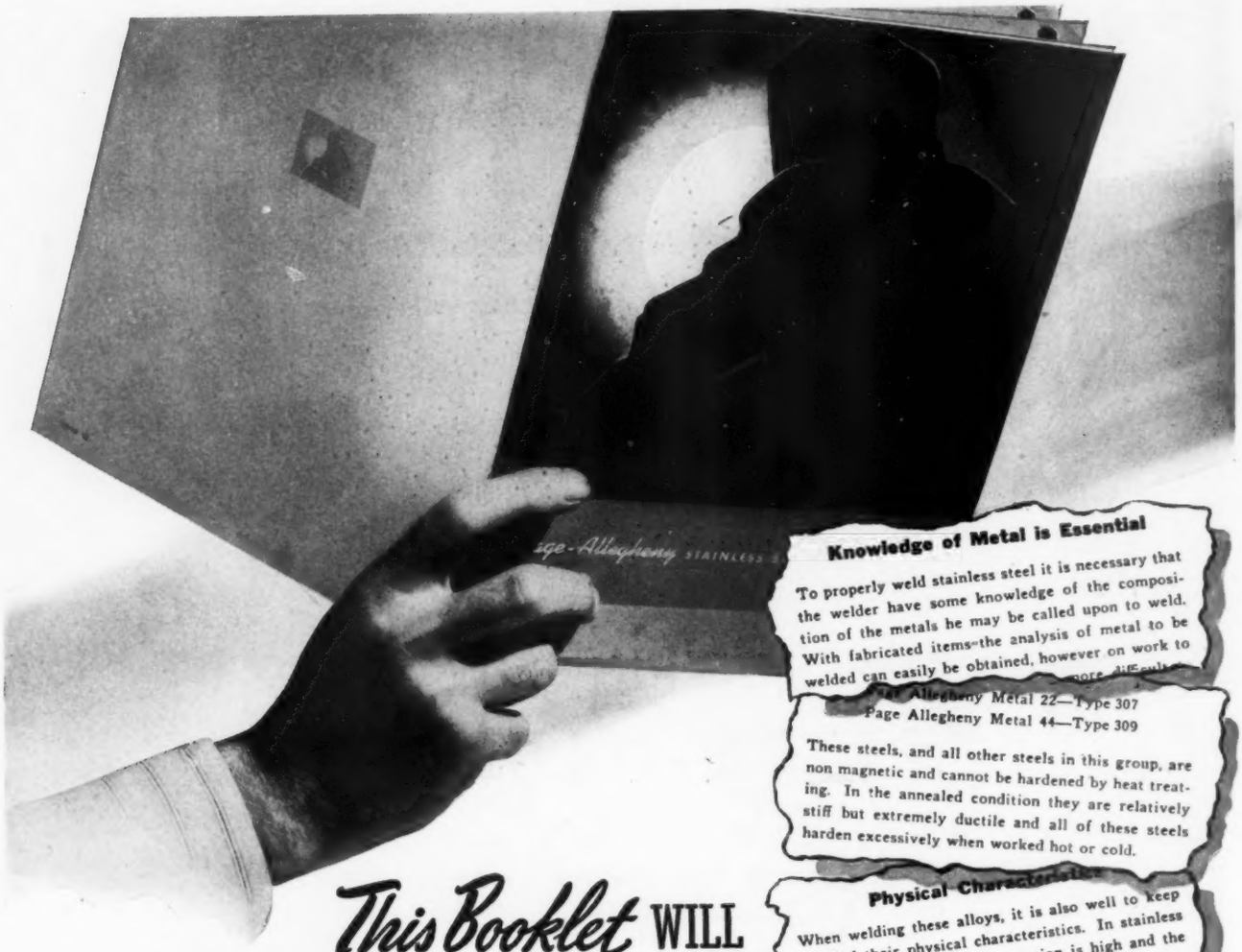

This Booklet WILL HELP YOU SAVE TIME AND MATERIAL

..AND GET BETTER STAINLESS STEEL WELDS

WITH Stainless Steel on the critical list, it has become vital to take every possible means to conserve it.

It is worthwhile, for example, to instruct your men not to bend the electrodes and to use every one right down to the holder. Waste no part of them that can be used.

Then get the kind of information contained in this booklet by PAGE. It lists 42 grades of Stainless Steel with their type number and analyses. It lists the electrodes to use with these. And it gives such needed data as the physical characteristics of certain well-defined groups of "Stainless"—their reaction to heat and to cold working, etc. It gives such definite instructions as correct amperage and voltage; polarity, length of arc; direction of arc; starting the weld; preventing undercutting, etc.

Ask your local PAGE Distributor for a copy of this booklet.

Knowledge of Metal is Essential

To properly weld stainless steel it is necessary that the welder have some knowledge of the composition of the metals he may be called upon to weld. With fabricated items—the analysis of metal to be welded can easily be obtained, however on work to

Page Allegheny Metal 22—Type 307
Page Allegheny Metal 44—Type 309

These steels, and all other steels in this group, are non magnetic and cannot be hardened by heat treating. In the annealed condition they are relatively stiff but extremely ductile and all of these steels harden excessively when worked hot or cold.

Physical Characteristics

When welding these alloys, it is also well to keep in mind their physical characteristics. In stainless steels, the coefficient of expansion is high and the heat conductivity is low, therefore, when setting up a job for welding these factors must be taken into account and allowance made for expansion and con-

STANDARD GRADES

The following list shows standard grades of stainless steels. Those which are not included in the standard classif on special order.

GRADE	TYPE NO.	CARBON	CHROME	
Allegheny 17/7	301X	.10-.20	16.00-18.00	
Allegheny "C"	302	Over .08-.20	17.00-19.00	
	302B	Over .08-.20	17.00-19.00	
Allegheny Metal F.M.*	303	.20 max.	17.00-19.00	
Allegheny "A"	304	.11 max.	17.00-19.00	
Allegheny "B"	305	Over .08-.20	18.00-20.00	
Allegheny "B" Spec.	306	.11 max.	18.00-20.00	
Allegheny 22	306	Over .08-.20	19.00-22.00	

PAGE-ALLEGHENY STAINLESS STEEL ELECTRODES

CHROMIUM 18.
NICKEL 8.
CARBON .07 Max.
with COLUMBIUM
SIZE HEAT POUNDS NET

PAGE-ALLEGHENY 18-8 ELECTRODES with COLUMBIUM

Base metal and coating balanced to form weld metal of the following chemical composition: Carbon .07% Maximum: Chromium 18% Minimum. Nickel 8% Minimum with Columbium.

Recommended for welding all grades of Stainless Steel in which the chrome and nickel

PAGE-ALLEGHENY STAINLESS STEEL ELECTRODES

CHROMIUM 19.
NICKEL 9.
CARBON .07 Max.
SIZE HEAT POUNDS NET

PAGE-ALLEGHENY 19-9 ELECTRODES

Base metal and coating balanced to form weld metal of the following chemical composition: Carbon .07% Maximum: Chromium 19% Minimum: Nickel 9% Minimum.

Recommended for welding all grades of stainless steel in which the Chrome and Nickel content is not in excess of 19% and 9% respectively.

PAGE WELDING ELECTRODES

PAGE STEEL AND WIRE DIVISION • MONESSEN, PA., ATLANTA, CHICAGO, NEW YORK, PITTSBURGH, SAN FRANCISCO

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

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26-PAGE CATALOG

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COVERING
ALL IMPORTANT
SHELL and SHOT
MACHINING OPERATIONS

★

. . . Available on request only to manufacturers of shell or shot or to companies negotiating for such manufacture

★

This catalog contains general information on a series of 32 basic single purpose machine tools engineered for each size and type of shell and shot. The machines described perform all the major machining operations involved in the production of shell and shot within the size range of from 2" to 12" and equivalent metric sizes.

In requesting information, kindly advise type and size of shell or shot and production requirements per hour to enable us to give you specific recommendations.

To conserve time, address inquiries to United States Representatives, Hepburn American Company, Greenwich, Connecticut.

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ENGINEERS AND MACHINE TOOL BUILDERS

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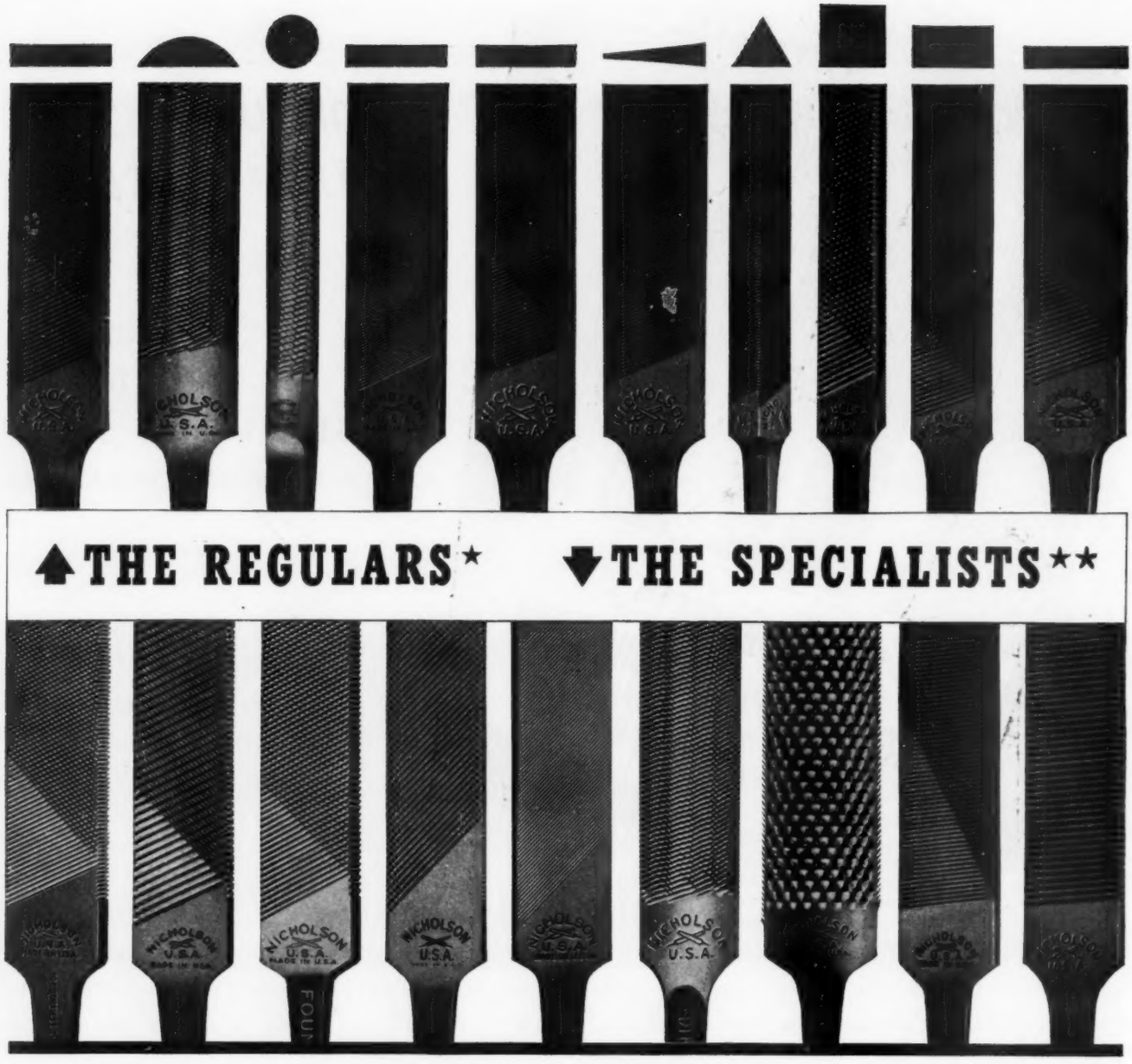


▲THE REGULARS★ ▼THE SPECIALISTS★★

You can command what is probably the most complete army of files in the world when you make Nicholson or Black Diamond brands your standard.

Thus, production lines keep moving, and maintenance and repair work steps along, when your men can always lay their hands on *The right file for the job.*

And when there are special filing problems to be mastered, Nicholson is always a source of help to which you can turn.

Toward meeting heavy war-industry demands, the above are some of the most needed file types under maximum production in the Nicholson factories:

★**REGULAR PURPOSE** (*left to right*)—Flat, Half Round, Round, Mill, Warding, Knife, Three-Square, Square, Pillar, Hand.

★★**SPECIAL PURPOSE** (*left to right*)—For Stainless Steel, Aluminum "A," Foundry, Shear Tooth, Long Angle Lathe, Die Cast, Aluminum Rasp, Brass and Lead Float.

To win the war, we're co-operating with industry—with all we've got! For your file needs, consult your mill-supply house. The Nicholson guarantee: *Twelve perfect files in every dozen.*

NICHOLSON FILE CO., PROVIDENCE, R. I., U. S. A.

(Also Canadian Plant, Port Hope, Ont.)

LET'S GO! U.S.A. · KEEP 'EM FLYING!

NICHOLSON FILES

FOR EVERY PURPOSE

NICHOLSON U.S.A. MADE IN U. S. A.

Here's a 48 to 60 hour week —by working 40 hours!

Everybody says our greatest shortage in the war program is TIME. Here's how to get the welding output of 48 to 60 hours with no more effort and no more time than 40 hours.

ALTER EGO: And how simple! Just select the proper electrode, use the new "Fleet-Fillet" Technique, boost the current—then speed like blazes!

Speed is right! At 50% operating factor, I used to make 15 feet per hour on these 3/8" fillets. Now, with this new "Fleet-Fillet" Technique, I'm getting 30 feet per hour. Twice as fast!

ALTER EGO: And look at the weld metal you save! All in all, the boss says this new technique has cut welding costs more than 50%.

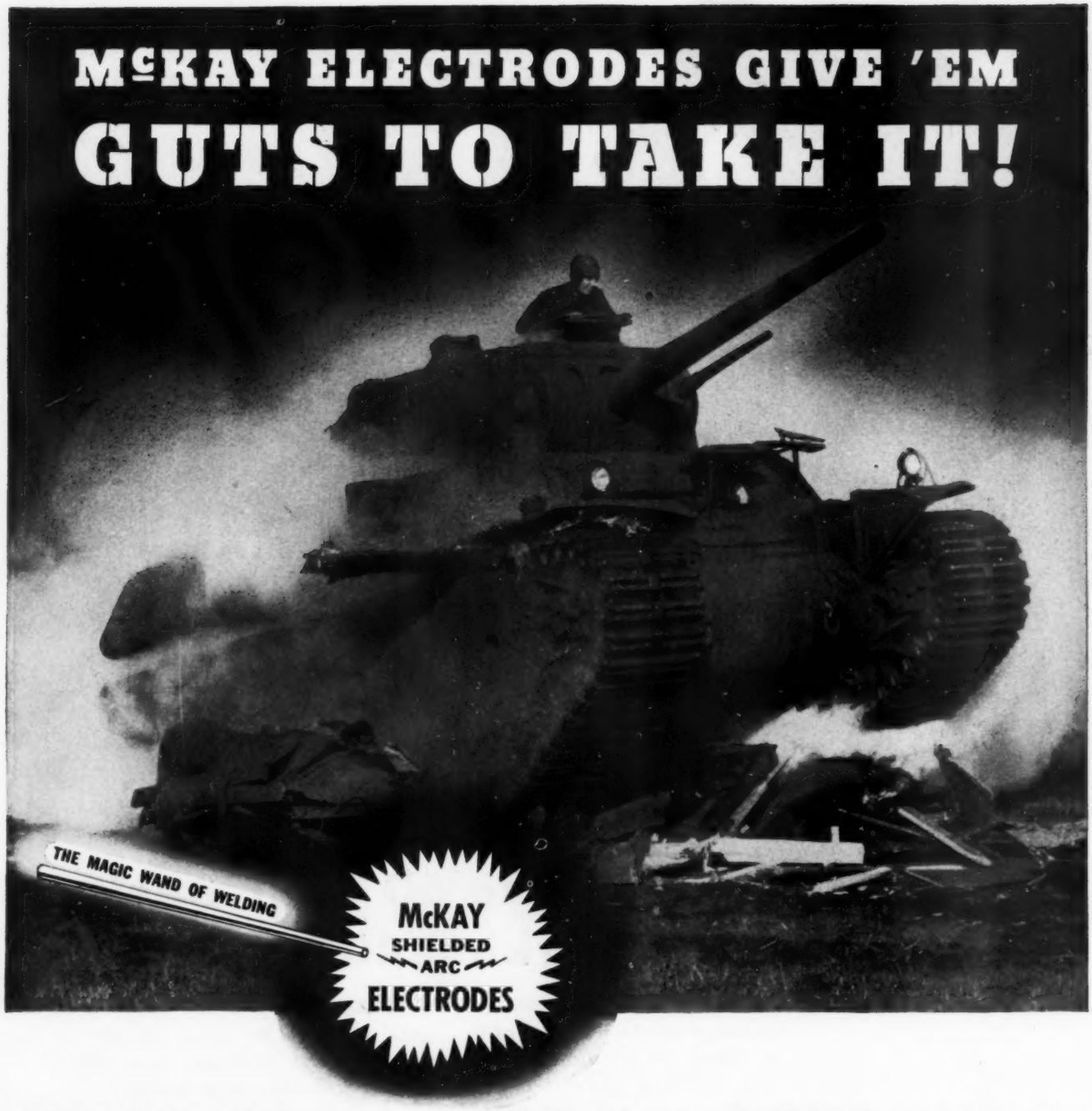
That's why every welder, supervisor, engineer and executive in metal-working industries should air mail a letter to The Lincoln Electric Company, Cleveland, Ohio, for their book on the new "Fleet-Fillet" Technique so that they can put this time saver to work for Uncle Sam at once.

Free copy "Fleet-Fillet" Bulletin No. 432 on request.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

ALTER EGO: Literally, "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.

McKAY ELECTRODES GIVE 'EM GUTS TO TAKE IT!



McKAY Shielded Arc-Welding Electrodes, in the skillful hands of America's welders, are performing near-miracles in production-for-war . . . SAVING as they SERVE! Saving time, man power, facilities, vital material . . . eliminating the danger of flying rivets in battle . . . joining armor plate into strong, fully integrated structures!

McKAY Electrodes are developed by practical engineers and scientists and manufactured under rigid supervision. From exhaustive research and painstaking production have come such strategically important Electrodes as McKAY Armorloy "A" and Armorloy "C"... the most advanced rods for welding armor plate yet available!

THE McKAY COMPANY • PITTSBURGH, PA.

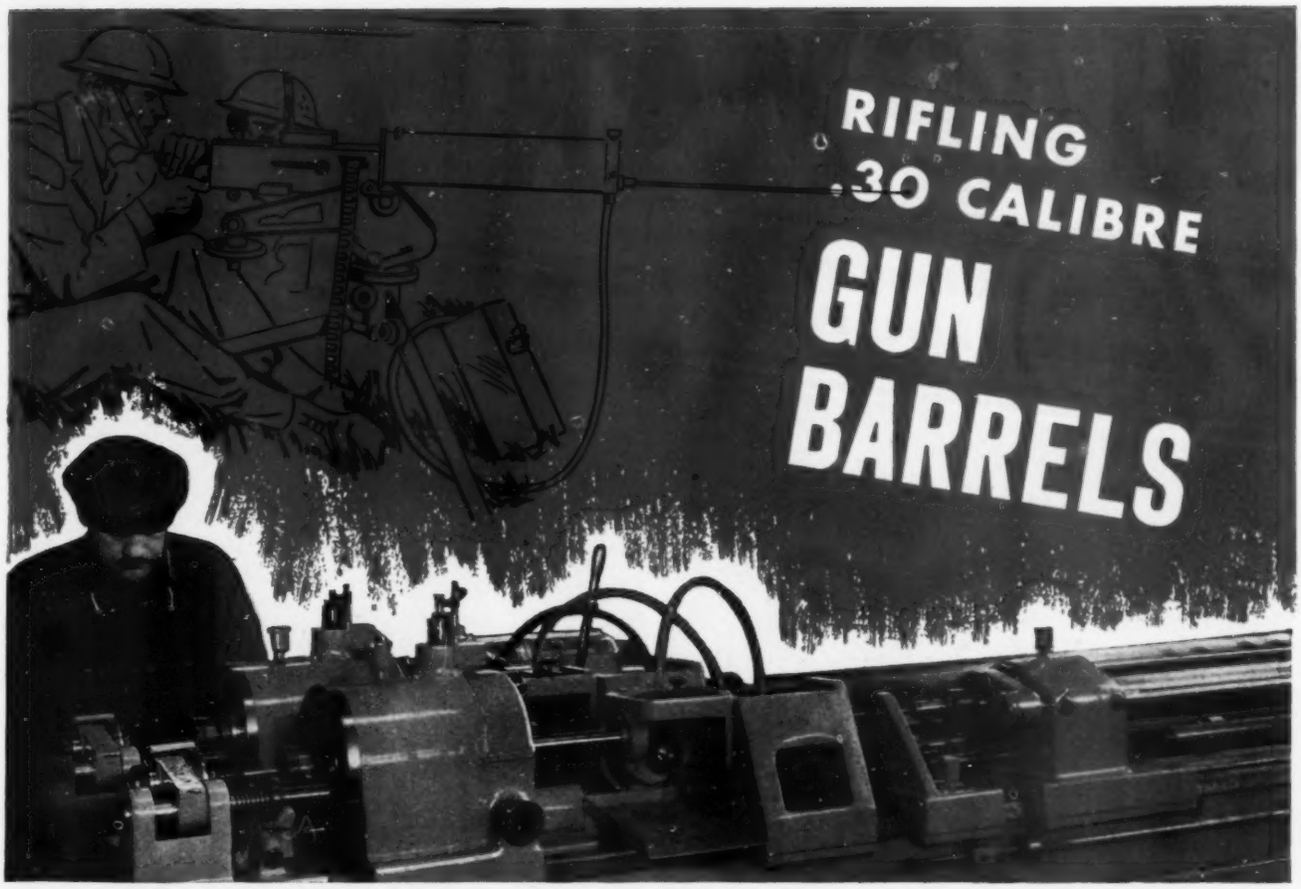
PACIFIC COAST SALES OFFICES: 125 S. Santa Fe Ave., Los Angeles · 100 Howard St., San Francisco

The McKay line includes regular carbon steel, stainless, and alloy steel electrodes for every welding purpose. Literature on request.

The McKay Company was among the first honored with the coveted Navy "E" award for excellence in fulfilling Naval Ordnance contracts.

McKAY WELDING ELECTRODES

AND INDUSTRIAL, MARINE AND AUTOMOTIVE CHAINS



Rifling barrels for .30-calibre machine guns. Great increase in broach-life is reported where *Texaco Transultex Cutting Oil* is in use.

"SOMEWHERE" in America, .30-calibre machine-gun barrels are being rifled at a rate that's extremely pleasing to the authorities.

After breaking broaches and pulling apart safety plugs, while using a certain well-known cutting coolant, the job was put on *TEXACO Transultex Cutting Oil B.*

Since *Texaco Transultex* has been in use, there have been no broken broaches nor ruptured safety plugs, while those in charge recognize such benefits as—*increased output, greater accuracy, better finish, greater broach-life, lower broach cost.*

The outstanding performance that has made Texaco preferred in the fields listed in the panel has also made it preferred by prominent users in the metal cutting field.

Texaco users enjoy many benefits that can also be yours. A Texaco Engineer specializing in cutting coolants will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distribution points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

Care for your Car ..for your Country

THEY PREFER TEXACO

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

FOR YOUR ENJOYMENT
FRED ALLEN every Sunday night. See your local newspaper for time and station.

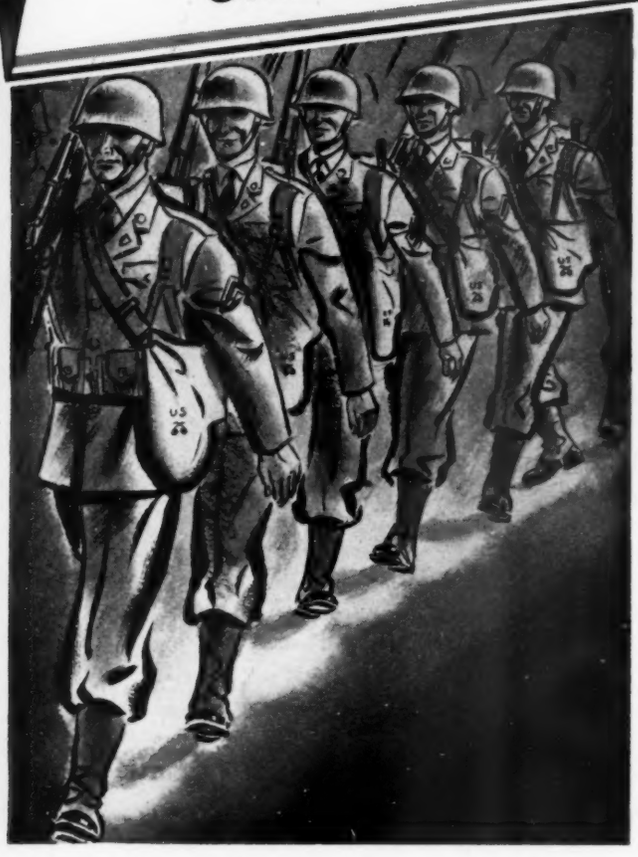
HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

TEXACO REG. T.M.

TEXACO Cutting and Soluble Oils
FOR THE METAL-WORKING INDUSTRY

CHAPMANIZING

Turns Millions of Peacetime Steel Parts ★★★ *into "TOUGH SOLDIERS" Overnight*



This unique steel-hardening process gives wearing parts a tough-ductile case from .002″ to .035″ deep, in 4 hours at the most. And these cases are clean and uniformly hard . . . *won't* chip or distort under bending, abrasion, or sliding pressure . . . *will* stand up under wartime's non-stop operating conditions.

Many metal-procurement problems can be solved, too, for Chapmanizing gives free-machining steels the wearability of many critical alloys, where specifications make substitution possible. So if *you* need to speed production and save time . . . both in hardening and finish-grinding . . . find out in detail what Chapmanizing can do for you. Write to any of the Chapmanizing licensees listed . . . or to the Metallurgical Sales Division of:

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COMMERCIAL STEEL TREATING CO., Detroit, Mich.
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NINE VOLUMES OF IMAGINEERING

THESE NINE BOOKS are designed to help all men, everywhere, do the Imagineering that improves methods of production and speeds delivery to our fighting men of all war materiel made of aluminum.

HERE AT ALCOA, Imagineering has enabled us to double production and to be well on the way to tripling it, in an amazingly short time. And still the expansion goes on. Swinging immense new plants into top volume at top speed;

building again, and manning that new capacity efficiently . . . This is Imagineering at work for the war.

WE'RE BREAKING RECORDS by sheer determination backed by know-how.

YOU'RE DOING THE SAME. Perhaps your men, many of them new to the ways of working with aluminum, can help you get even more speed through the know-how these books contain.

IN THE DAYS when we made only a driblet of Alcoa Aluminum Alloys, compared to the great flood we are now pouring into the war effort, our engineers could counsel with you personally on fabricating procedures. Today many of these men have been brought back to our plants to join the drive for production. From these books you can get much of the know-how our men used to bring you personally.

OUT OF THESE PAGES, too, will come the exciting Imagineering of the future. Many of the products you will create to meet the new competition, *as well as* millions of jobs for our boys as they come home, will stem from that Imagineering.

Aluminum Company of America, 2107 Gulf Building, Pittsburgh, Pennsylvania.

★ SO MUCH SO SOON ★

ALCOA ALUMINUM

BOUT of the O'TOOLS

10 ROUNDS—
AIR vs. HIGH-CYCLE
GRINDERS

WE WANT TO FIGHT FOR GREATER OUTPUT IN YOUR PLANT!

So far in this Bout of the O'Tools, HIGH-CYCLE and AIR have taken 2 rounds each:

Round 1—HIGH-CYCLE grinders boosted output 25%, saved $1695 in first cost.

Round 2—Light-weight AIR grinders improved maneuverability, upped output 10%.

Round 3—HIGH-CYCLE grinders doubled production with 5 less tools, saved 75% in power cost.

Round 4—Light-weight AIR grinders made possible smoother results, cut maintenance costs 15%.

And the fight goes on! In fact, we're staging it daily in scores of plants—analyzing portable tool problems—finding ways to boost output and cut costs with either AIR or HIGH-CYCLE tools.

We'd be glad to tackle *your* problems in this unbiased manner to give *you* "all-out" portable tool output.

THE ROTOR ANALYST

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Free on request.

"HIGH-CYCLE" Cat. 25
Free on request.

AIR

HIGH CYCLE

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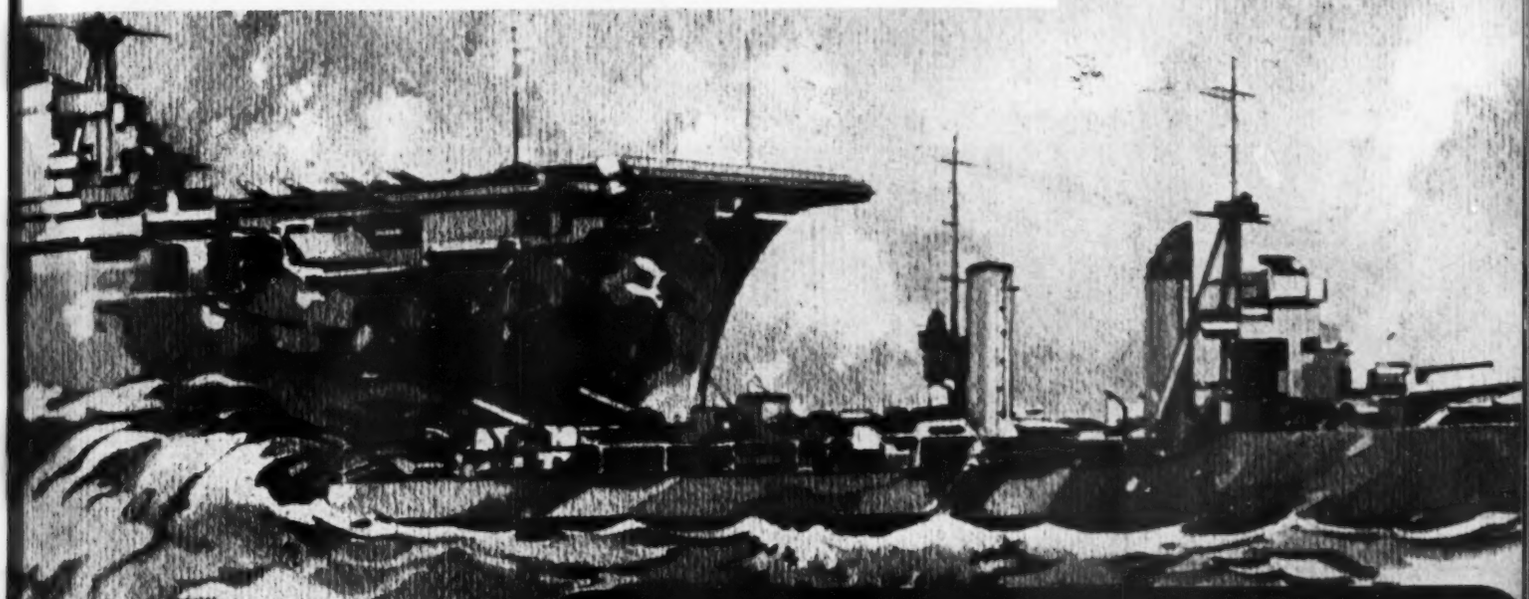
CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

ON THE MACHINE-TOOL FRONT!

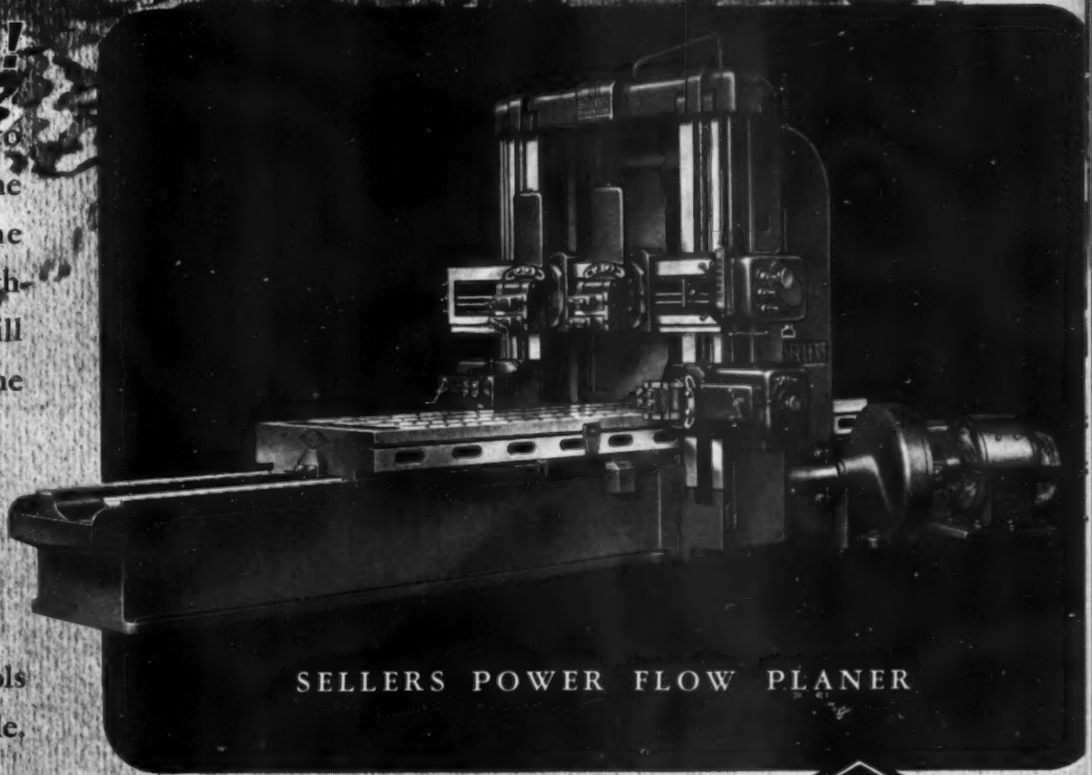
Continuous, Top-Speed Production---



PRODUCE!

THE job that has fallen to the men who operate the machines that produce the weapons and equipment with which our fighting men will avenge Pearl Harbor is of the utmost urgency.

Continuous top-speed production is the best way by which industry can "remember." Sellers' and other great machine tools are helping make this possible.



SELLERS POWER FLOW PLANER

WILLIAM SELLERS & CO., INCORPORATED · PHILADELPHIA

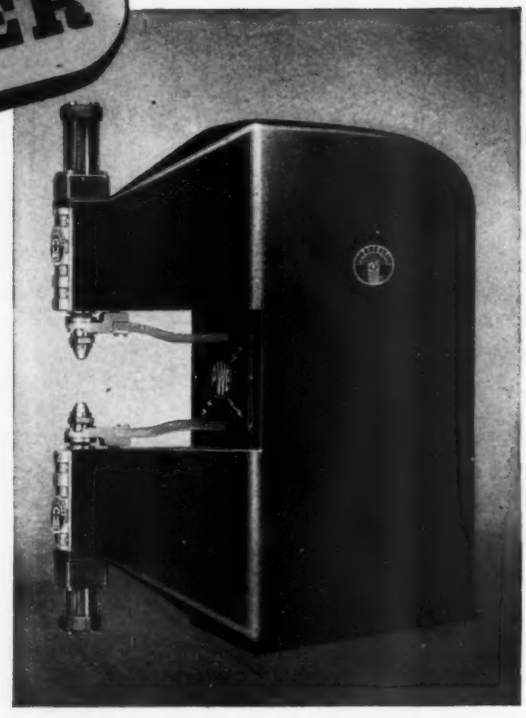
FOUNDED SELLERS 1848

Sellers

APPROVED BY RECOGNIZED BUREAUS

Announcing the TEMP-A-TROL* FORGE WELDER

*Copyrighted and patented. Other patents applied for.



"The machine that thinks for itself"

for

for

WHAT IT DOES:

1. Welds
2. Heat-treats
3. Controls: Ductility, grain refinement, homogenization. Avoids annealing of hardened surface.
4. Eliminates the human element in selecting weld and heat-treat cycles, etc.

DESIGNED FOR:

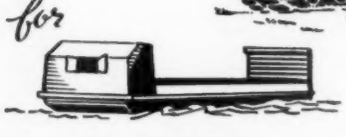
1. Resistance welding of heavy sections, and of
2. Special alloy steels, such as homogeneous and face-hardened armor plate, etc.

HOW IT DOES IT:

1. Temperature AT the weld itself controls weld and heat-treat cycles—*automatically.*
2. Merely set dials for weld and heat-treat temperatures desired. Machine is self-compensating for all such variations as normal differences in metal thickness, induction and short-circuiting losses, presence of scale, etc.

for

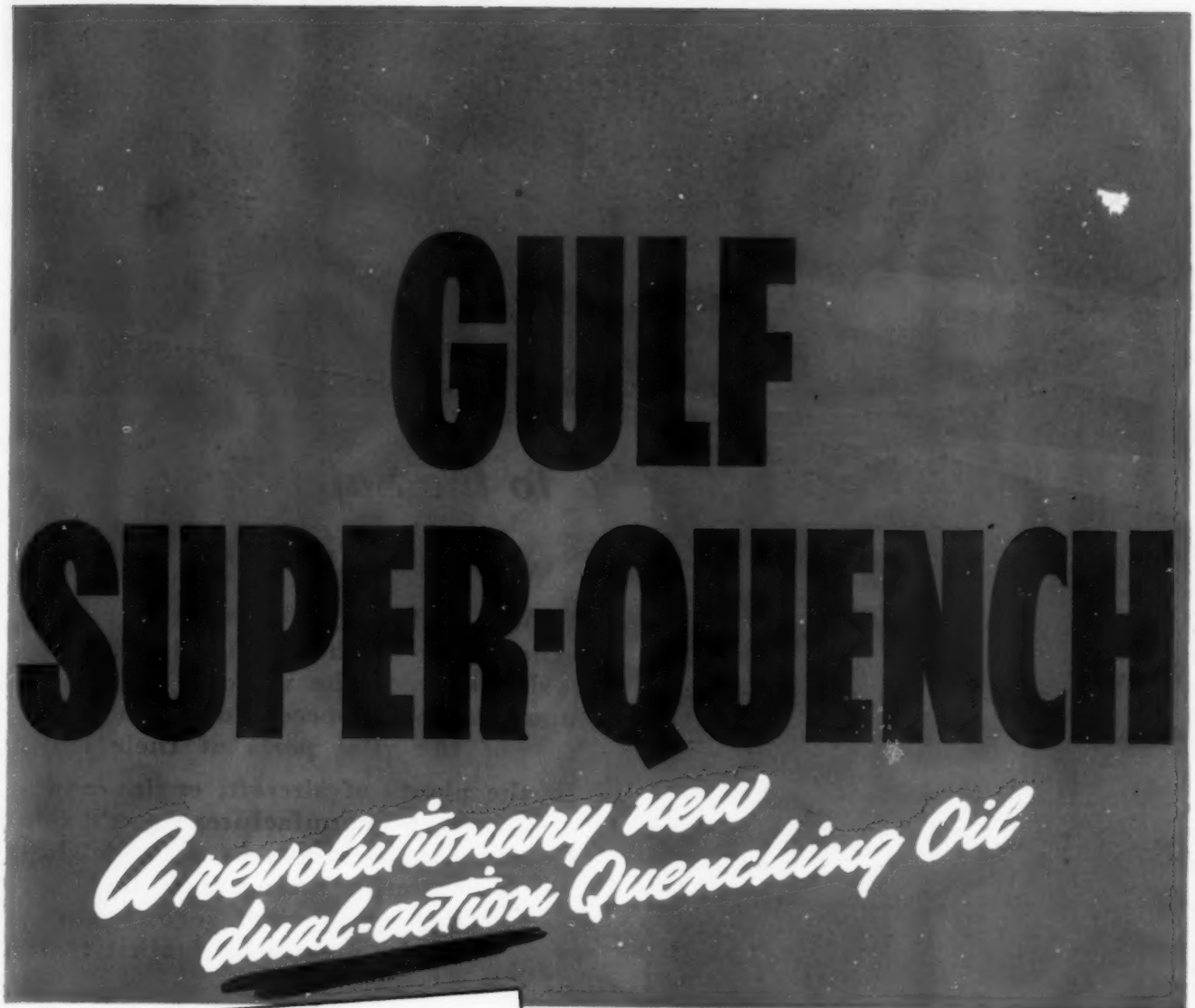
for



Information on the new process will be furnished at present only to organizations engaged in or contracted to engage in war production work. Please address all inquiries direct to:

PROGRESSIVE WELDER CO.

3050 EAST OUTER DRIVE **DETROIT, MICHIGAN**



2 Important Reasons Why

GULF SUPER-QUENCH GIVES UNMATCHED QUENCHING PERFORMANCE

1. Gulf Super-Quench imparts the maximum hardness and greatest depth of hardening obtainable by quenching in any except aqueous quenching media.

2. Gulf Super-Quench retains the same minimum tendency towards distortion and cracking that is characteristic of oil quenching media.

HERE is the quenching medium long sought by metallurgists! With a faster cooling rate than any known quenching oil, Gulf Super-Quench has *dual-action:* (1) It has a cooling rate intermediate between oil and water through the hardening temperature range. (2) It retains the slow speed of oil below the hardening temperature range.

Thus Super-Quench secures maximum physical properties, with minimum distortion of oil quenching—far less than water.

Developed through extensive research in Gulf laboratories, Super-Quench has been proven by service in the field—on different types of steels, and on various shapes. In many instances, quenching with this new medium has resulted in a marked improvement in physical properties.

Gulf engineers are at your service to consult with you on your quenching problems. For further information, write today to Gulf Oil Corporation, 3800 Gulf Bldg., Pittsburgh, Pa.

GULF INDUSTRIAL LUBRICATION

MAIL THIS COUPON TODAY

Gulf Oil Corporation · Gulf Refining Company AM
3800 Gulf Building, Pittsburgh, Pa.

Please send me, without obligation, complete information on Super-Quench, your new dual-action quenching oil.

Name_____

Company_____

Address_____

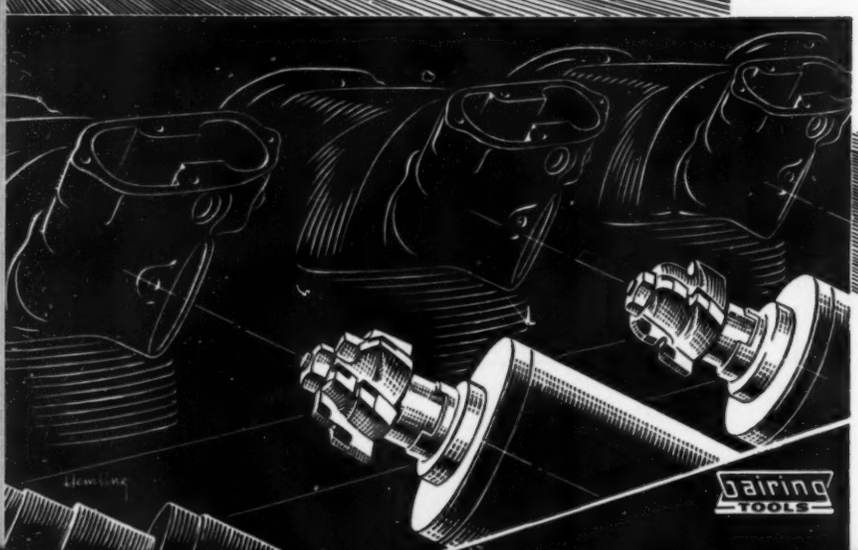
to the Safety of Sky Riders

In War or Peace, in foul weather or fair, the safety of those who ride the sky fleets of the world is dependent upon the power, speed and accuracy of the vital parts of their craft.

In the plants of aircraft, engine and parts manufacturers, you'll find Gairing Cutting Tools on multiple shift schedules, assuring accuracy that saves vital seconds in the grim race against time.

Standard tools, special tools for handling unusual specifications, and Gair-Lock inserted blade cutters—their design and manufacture have been our contribution to Industry for a quarter of a century.

THE GAIRING TOOL COMPANY
Detroit, Michigan



GAIRING
FOR A QUARTER CENTURY
SPECIALISTS IN FINE CUTTING TOOLS

Close-up of Gairing Cutting Tools rough boring, cutting radii and face, finish boring and chamfering intake port faces in rear cylinder heads of aircraft engines.

2 TO 5 TIMES
MORE PRODUCTION
PER MAN PER MACHINE

"DID I GAMBLE?"...

I'm asking myself (and you) a question. I "risked" a test of Por-os-way grinding wheels to grind 1/32" lands in 10 D.P. high speed steel milling cutters for herringbone gears. Unlike previous wheel, found that Por-os-way required dressing only between rough and finish cuts, held its corners, cut freely. Installed Por-os-way with much faster results—and better. **Did I Gamble?**

Now! Grind hard tool steels with ease; also soft materials with less loading. Speed up 2 to 5 times!

*Copyright 1942, A. P. DE SANNO & SON, INC.

EXAMINE THE STRUCTURE of this new precision grinding wheel. It's not compact, but cellular and *porous*—something like a sponge!

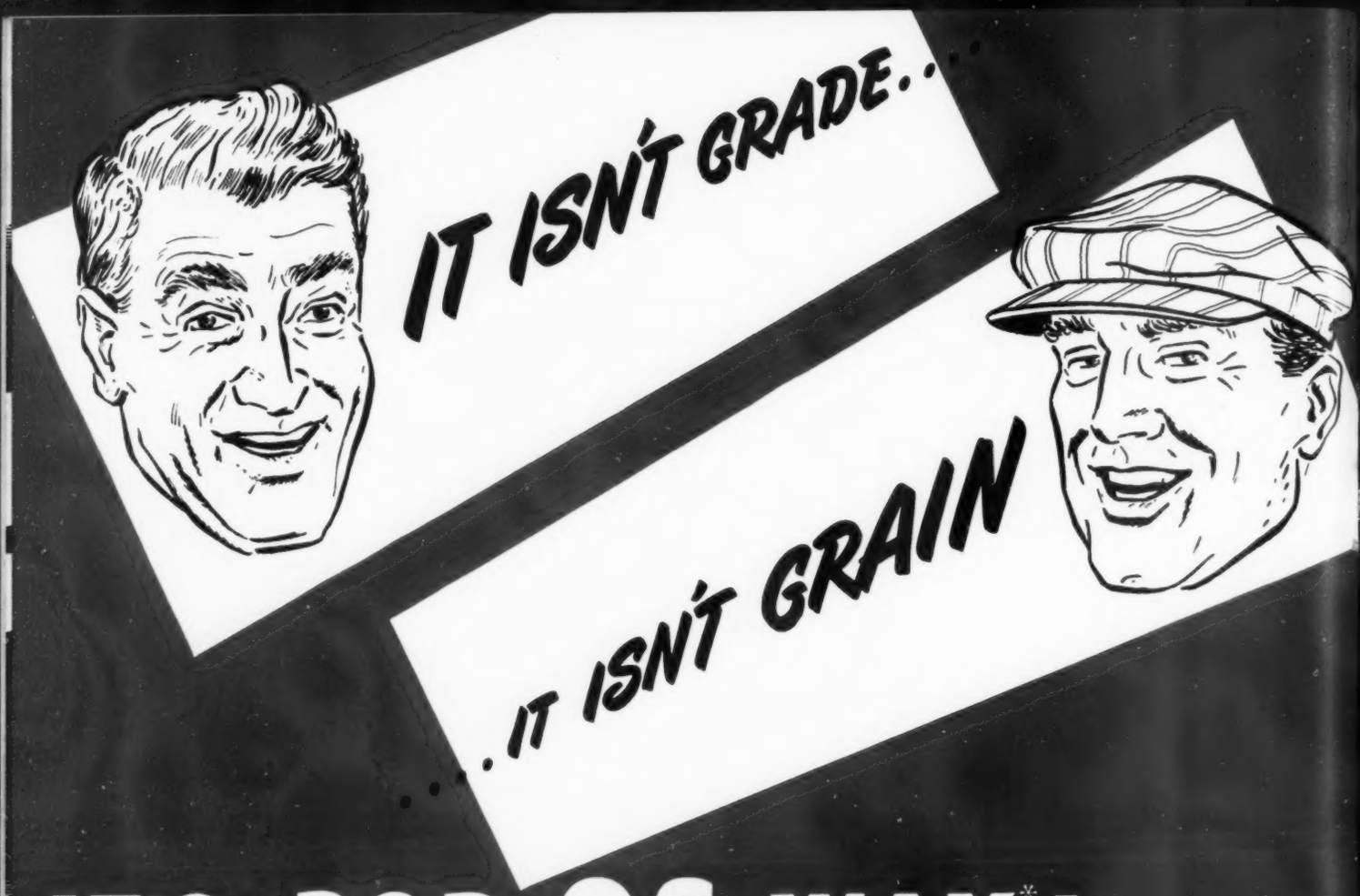
Properly used Por-os-way takes deeper cuts. It breezes through .010" or more. It grinds 100% to 400% faster. It increases production per man, per machine, 2 to 5 times, practically ends "burning." Por-os-way's unique structure makes possible these results. Air cells surround and cool each grinding point between contacts.

Use Por-os-way on hard steels and alloys. Use it also on softer materials: copper, aluminum, tin, wood, plastics. Por-os-way holds the corner with very little dressing, due to the new vitrified bond. On softer materials, loading is reduced surprisingly. Por-os-way is more free cutting.

See this wheel. Try it. Prove on your own machines the new grinding speed now possible. Ask for a "proof test" demonstration! A. P. DE SANNO & SON, INC., 430 Wheatland St., PHOENIXVILLE, PA.

POR-OS-WAY* *a new* **RADIAC* PRODUCT**

(TURN PAGE, PLEASE)



IT'S POR-OS-WAY*!

That produces 2 to 5 times more work per man per machine

FOR YEARS grinding wheels have been selected simply by grade and grain.

Radiac offers you a whole new interpretation of grinding — Por-os-way. Here it is in a few words: A Por-os-way wheel contains millions of air cells. These air cells surround and cool each grinding point. Thus Por-os-way practically eliminates burning, reduces glazing and loading to a minimum. You can take cuts two, three, or more times deeper at your usual speeds or your usual cut 2 to 5 times faster. It's the wheel for hard tool steels, aluminum, brass, tin, rubber, plastics, wood . . . almost any material. Write for the booklet that "Tells all" and includes a "prescription" form for specification of Por-os-way to your own application.

DO THIS — MAKE THE SMOKE TEST

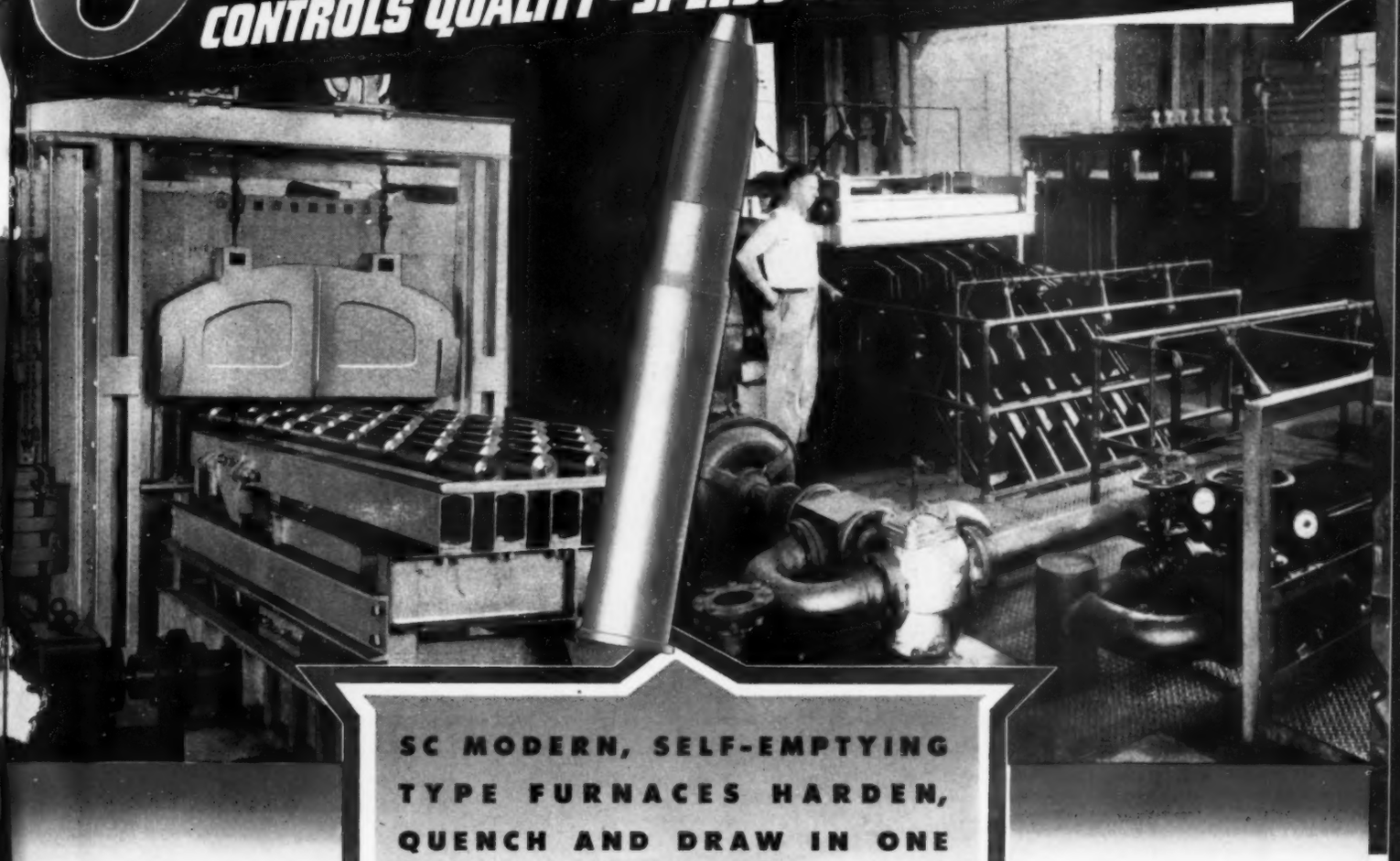
Put your lips to a Por-os-way wheel and blow smoke through it. Watch the smoke stream freely through the millions of air cells. These cells, cooling each grinding point, step up production 2 to 5 times per man per machine.

POR-OS-WAY* *a new* **RADIAC* PRODUCT**

R. P. DE SANNO & SON, INC., 430 Wheatland Street, PHOENIXVILLE, PENNA. • SINCE 1883
Offices and Warehouses in Pittsburgh, Cleveland, Detroit, Chicago, Los Angeles

ONE-MAN SC UNIT

CONTROLS QUALITY - SPEEDS ARSENAL PRODUCTION



SC MODERN, SELF-EMPTYING TYPE FURNACES HARDEN, QUENCH AND DRAW IN ONE CONTINUOUS OPERATION...

THE "LAST WORD" IN AUTOMATIC HEAT TREATING OF CHEMICAL AND HIGH EXPLOSIVE SHELLS AND PROJECTILES.

★

★ Little does science depend upon man for the heat treating of shells in this leading arsenal. After the shells have been placed on the walking beam conveyor at the charge end of the hardening furnace, mechanisms make possible metallurgically correct heating, oil quenching and drawing of shells in one complete and automatic operation.

The operation of all furnace conveyor units is controlled by a timing clock which starts and stops all drives simultaneously, at pre-determined intervals.

The walking beam feature permits each shell to receive the same time, temperature and treatment. Equal space surrounds each shell, and as the shell is mechanically moved through the processing operation its point of contact on the beams is constantly changed, giving uniform heat treatment. Such handling forms a breathing action highly beneficial to finished product quality.

The quenching operation utilizes individual oil sprays which force the liquid into the cavity end of each projectile and around the outside surface, eliminating vapor pockets.

Both internal and external quenching is accomplished effectively and simultaneously. Then each shell is tipped mechanically and deposited on the flight conveyor which carries them up and on to the charging end of the draw furnace.

This popular SC Unit is representative of many heat treating installations where SC Engineers have met the problems of industry with efficient and practical heat and heat treating equipment. Further details are given in the bulletin, "Advances In High Explosive Shell Manufacture." Write for it.

SURFACE COMBUSTION...TOLEDO, OHIO

"SECURITY FOR AMERICA"

SURFACE COMBUSTION

MANUFACTURERS OF INDUSTRIAL FURNACES · JANITROL GAS-FIRED SPACE HEATING EQUIPMENT · AND KATHABAR AIR CONDITIONING SYSTEMS

DEGREASE AND CLEAN ALL YOUR WAR PRODUCTS

...the fast, performance-proved OAKITE WAY

BEFORE painting, lacquering or applying black, corrosion-resistant finishes . . . or before spot-welding, electro-plating, anodizing, tinning or galvanizing operations . . . you will find specialized Oakite alkaline, emulsifying, acid and-solvent-type degreasing and cleaning materials provide the FAST, uniform, trouble-free results your war production schedule requires.

Used in automatic washing machines or tanks, these dependable Oakite materials keep rejects down, keep production lines flowing smoothly by thoroughly, speedily removing oil, grease, smut, soldering fluxes, polishing and buffing compounds and other deposits. See list below for types of war work on which Oakite materials are specified and used by prime and sub-contractors.

War-Time Oakite Service FREE!

Whether or not you are now using Oakite materials, all our facilities . . . our Nation-Wide Field Staff, our Chemical Research and Mechanical Engineering Laboratories . . . are freely available, day or night, to render helpful service on any war production degreasing or cleaning operation you want performed FASTER and EASIER! Your inquiries invited . . . no obligation.

IS THE WAR SUPPLY ITEM YOU ARE PRODUCING LISTED HERE?

Over 60 different Oakite materials are available that meet every production degreasing or cleaning specification on war orders. Prompt delivery assured from nearby warehouse stocks.

AIRPLANES
AIRPLANE MOTORS
FLIGHT INSTRUMENTS
AIRPLANE PARTS
BOMB FIN ASSEMBLIES
BOOSTER CAPS
FUZES & FUZE PARTS

POWDER BOXES
CARTRIDGE CASES
SHELLS
SHELL CASES
FLARE BOMB CASES
DEMOLITION BOMBS
INCENDIARY BOMBS

PRACTICE BOMBS
GRENADES
LAND MINES
FIRE-CONTROL INSTRUMENTS
COMMUNICATION EQUIPMENT
RIFLES
SMALL ARMS AMMUNITION

GUN PARTS
MACHINE GUN MOUNTS
ANTI-AIRCRAFT GUNS
TRENCH MORTARS
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MOTORCYCLES
MOTOR SCOOTS

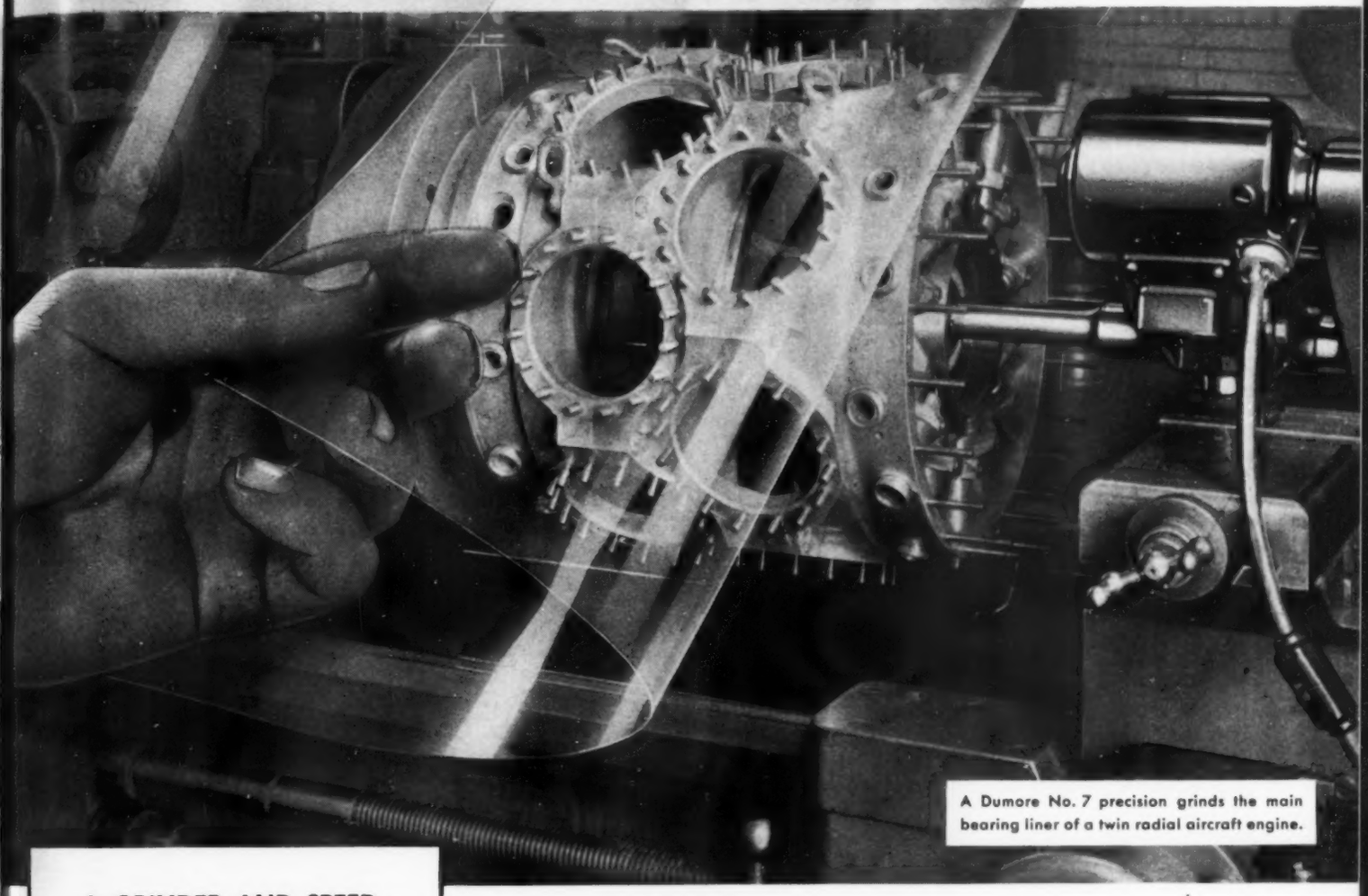
SCOUT CARS
TANKS
TRACTORS
TRANSPORT TRUCKS
GAS MASKS
HELMETS
ETC.

Manufactured only by
OAKITE PRODUCTS, INC., 24 Thames Street, NEW YORK, N. Y.
Representatives in All Principal Cities of the U. S. and Canada

OAKITE Specialized CLEANING
MATERIALS...METHODS...SERVICE
FOR EVERY CLEANING REQUIREMENT

1/12 the thickness of cellophane

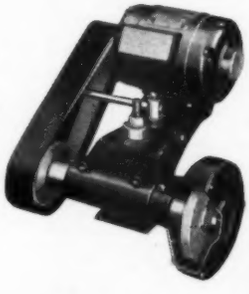
YOU CAN GRIND THAT ACCURATELY WITH A DUMORE



A Dumore No. 7 precision grinds the main bearing liner of a twin radial aircraft engine.

A GRINDER AND SPEED FOR EVERY NEED

"The Chief", with 1 h. p. motor, is a powerful grinding unit built to tackle the biggest and heaviest work—internal or external.



All the advantages of Dumore precision grinding are offered by this low cost 1/5 h. p. No. 11 "Speedee".

Cut costs and increase accuracy in tool rooms and on production lines! Do precision grinding *the Dumore way*. Speed up equipment you now have . . . modernize old machinery. Mounted on lathes, planers, shapers, milling machines, or other machine tools, Dumore Grinders consistently make savings averaging up to 30% in labor, time, spoilage and overhead. Dumore's are engineered to grind to .0001" accuracy . . . whether on a delicate finishing operation, or on heavy tools and forming dies. Internal and external applications for a Dumore are endless. Get all the facts at once. Call your nearest Dumore Industrial Distributor today.

THE DUMORE CO., 132-E RACINE, WISCONSIN

Dumore PRECISION Grinders

like having

4 EIGHT HOUR

This machine tool company starts with a 3 inch round steel rod which requires drilling, reaming and slotting. After the metal working operation is completed, there is a ¼ inch outside shell – the inside has been completely removed. Since they changed to Tide Water Cutting Oil the time to complete each unit has been reduced from 23.6 to 16.75 minutes. Tycol oils have stepped up production as much as another 8-hour shift. It further lowered machining time, increased tool life by some 70%.

Like hundreds of other companies, this concern knows the facts of increased production with modern Tycol Cutting Oils. Tycol sulphurized cutting oils will not gum or form deposits . . . will not turn rancid nor tarnish machined parts.

War production speed-up, through the proper application of the correct cutting oil and industrial lubricant, is the aim of Tide Water. Engineering assistance is available to help you achieve this end. For full details, write to the Tide Water Associated Oil Company, 17 Battery Place, New York, N. Y.

DRUMS! DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

INDUSTRIAL TYCOL OILS-GREASES

TIDE WATER ASSOCIATED OIL COMPANY EASTERN DIVISION 17 Battery Place, New York

Regional Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

SHIFTS PER DAY!
OIL IS AMMUNITION
USE IT WISELY !

HOW TO SAVE TIME IN GETTING STEEL

HERE ARE TWO SUGGESTIONS. Follow them and you'll save time—the most important thing in the world today—in getting the steel you need for *Production for Victory.*

1. Keep up to date on Governmental regulations and revisions—and follow procedure as established by the War Production Board.

2. Be sure to give your steel supplier *COMPLETE* information on your inquiries or orders. Always include:

★ Government contract number and specification (department, number, date) . . . War Production Board allocation order . . . preference rating certificate or endorsement . . . Army-Navy Munitions Board code number.

ALLOY and CARBON STEELS • STAINLESS STEEL • PLATES • TIN PLATE • NUTS • BOLTS • RIVETS • NAILS • PIG IRON BARS and SHAPES • STRIP • SHEETS • PIPE and TUBING • FARM FENCE • WIRE • FABRICATED STEEL PRODUCTS

★ Complete details on chemistry, physical properties and processing requirements (heat treatment, hardenability, etc.)

★ Full information on use of the steel. Be specific. Do not merely say "gears," but "a certain type of gear for a certain type and size of tank" or whatever the application may be. Sometimes several grades of steel may be suitable, but one may be more quickly available.

★ Make certain that all other necessary information is furnished—such as finishing required at the mill, nature of your first operation (for instance, is it cold shearing, saw cutting or other?), code painting specifications, shipping instructions, etc. The absence or incorrectness of these details may result in loss of time which cannot be recovered.

Complete information at the time the inquiry is made or the order placed will speed up clearance through Governmental agencies. It will speed up production of the steel and delivery to you. And, incidentally, it will save you the cost of extra correspondence, telegrams and 'phone calls.

We at Republic are working closely with Governmental agencies and customers. We're doing everything possible to help clear vital orders through to the mills so that the steel can be processed in the shortest possible time.

Won't you help us to help you speed *Production for Victory* by furnishing complete information when you need steel?

REPUBLIC STEEL CORPORATION

Alloy Steel Division Sales Offices: Massillon, Ohio • General Offices: Cleveland, Ohio

Berger Manufacturing Division • Culvert Division • Niles Steel Products Division
Steel and Tubes Division • Union Drawn Steel Division • Truscon Steel Company
• • *Export Department:* Chrysler Building, New York, New York • •

WAR DELIVERIES
fall short if machining output is not fully maintained. For promotion of top production in *MACHINE TOOLED* plants use . . .

...SINCLAIR CUTTING OILS and COOLANTS.
They keep cutting speeds high, temperatures low, and tool regrinds less frequent.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.

SINCLAIR INDUSTRIAL OILS

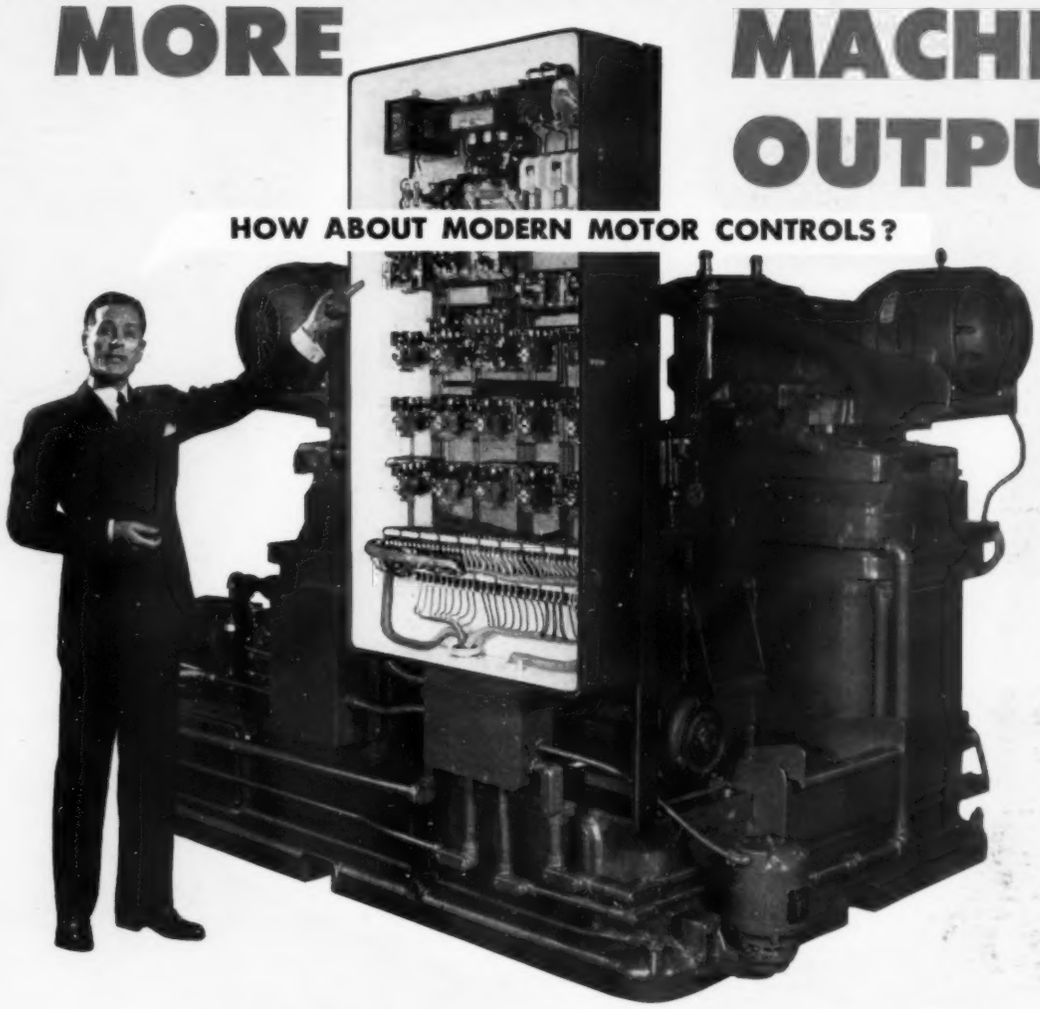
FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth

Are you struggling for MORE MACHINE OUTPUT?

HOW ABOUT MODERN MOTOR CONTROLS?



These are times when split seconds count up. Multiply split-second savings by thousands of machine operations . . . and you get an extra bomber, several tanks, or many more shells.

If you are struggling for more machine output, see that your motor controls are designed to get highest efficiency from operator and machine. Specify Allen-Bradley solenoid controls because they are not only consistent and accurate in their operating cycle . . . they are maintenance-free. There is only one moving part. No pivots, pins, or hinges to stick. No flexible jumpers to replace. No cleaning, dressing, or filing of contacts.

Allen-Bradley motor controls are available in single units in nine kinds of enclosures or assembled in complete panels for any multi-motored machine. Write for catalog, today.

A COMPLETE LINE OF CONTROLS FOR ALL TYPES OF MACHINES

Complete Panels | Automatic | Manual | Combination | Push Buttons | Reversing | Relays | Drums | Multispeed

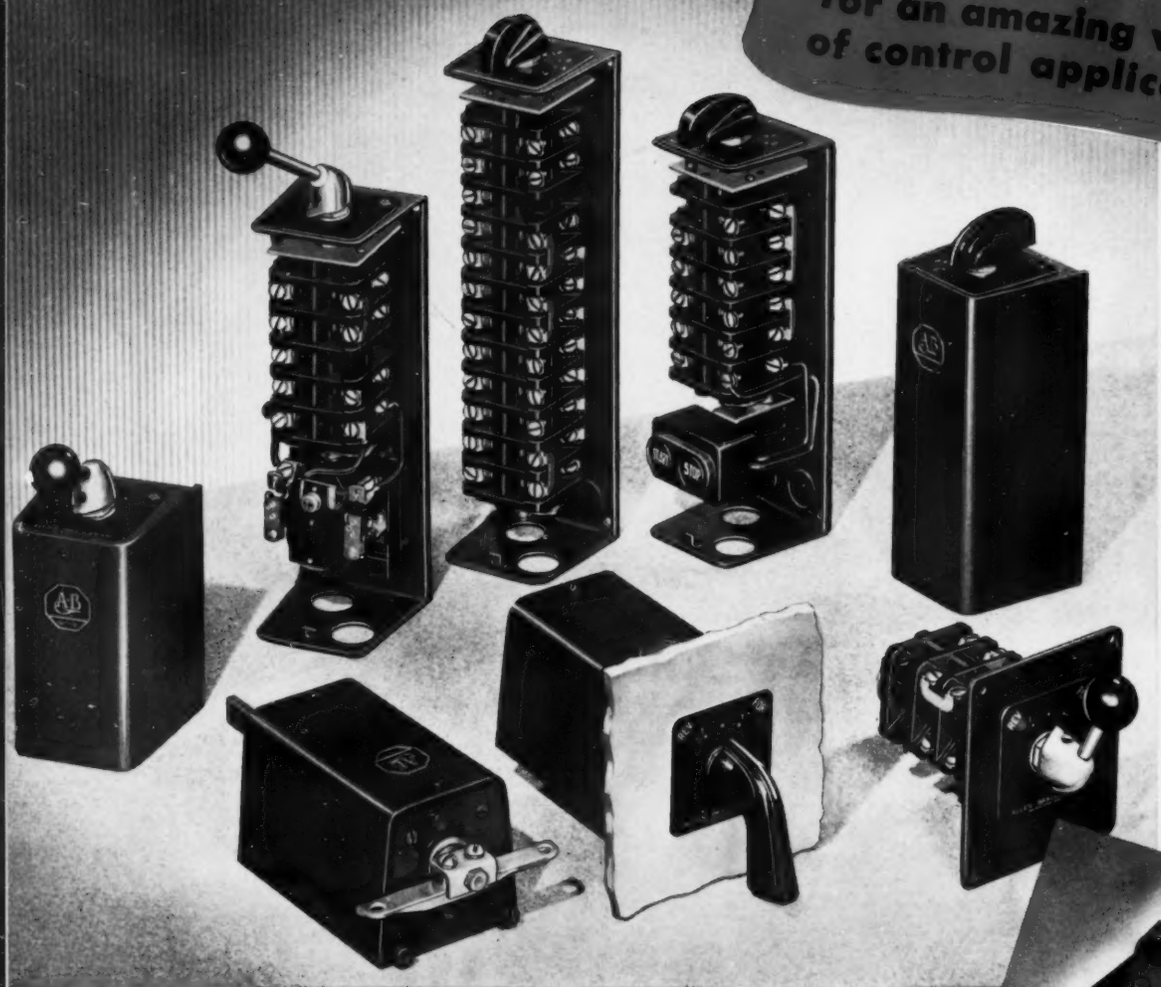
ALLEN-BRADLEY

MOTOR CONTROLS FOR ALL INDUSTRIES

QUALITY

A Line of SMALL DRUM SWITCHES

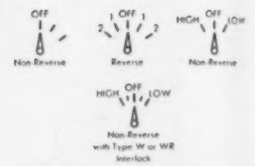
for an amazing variety of control applications



A FEW BULLETIN 353 DRUM SWITCH COMBINATIONS

The diagrams below illustrate a few of the large variety of switching combinations available with Bulletin 353 Drum Switches.

REVERSING SWITCH



2 SPEED SWITCHES

3 AND 4 SPEED SWITCHES

Many new and important units have been added to the popular Bulletin 353 line of small drum switches. These drum switches are now available with built-in push buttons; with electrical interlock for controlling magnetic main line switches; with a lever for rope operation. The individual switching units, with silver alloy contacts, permit an amazing range of contact arrangements. For full details, write for Bulletin 353 and price sheet.

Allen-Bradley Company, 1310 S. Second St., Milwaukee, Wis.

SECTIONAL UNIT SHOWING CONTACTS

The Bulletin 353 Drum Switch is a vertical assembly of individual switching units, each with its own contact arrangement and switching cam. There are no contact segments on the revolving shaft.

ALLEN-BRADLEY

BULLETIN 353 SMALL DRUM SWITCHES

QUALITY

KEEP 'EM SLIDING

with U.S. Office of Education

MOTION PICTURES

that help to teach

SHIP BUILDING!

10 ALL-IMPORTANT SUBJECTS:

(1) Preparing and setting a keel block and bottom cradle

(2) Inner Bottom Section: Sub-assembly of a closed floor, Sub-assembly of a solid floor

(3) Inner bottom section: Setting up and fitting floor

(4) Deck Girder: Sub-assembly

(5) Side Frame: Sub-assembly of a web frame

(6) Girders: Setting transverse web frame and a horning girder

(7) Bulkhead: Laying off the boundary and stiffeners on a transverse water-tight bulkhead

(8) Bulkhead: Laying off and fitting a center line stiffener

(9) Bulkhead: Setting a transverse, water-tight bulkhead and hull

(10) Deck Plates: Regulating and setting

USE THESE 23 FILMS ON MACHINE SHOP WORK!

5 on the Engine Lathe
5 on Precision Measuring
3 on the Shaper
5 on the Milling Machine
2 on the Radial Drill
3 on the Vertical Boring Mill

17 OTHER MACHINE SHOP SUBJECTS WILL BE RELEASED SOON!

Now! Now! Now is the time for the training of shipyard workers! Hundreds of shipbuilders and vocational schools are using these great films!

These motion pictures were produced by THE UNITED STATES GOVERNMENT for the specific purpose of aiding you in your vital work. They were made under the supervision of experts. Leading shipbuilding companies cooperated in their making. All are available in 16 mm. Sound-On-Film.

All of these films are low in cost, to give them the widest possible distribution. All are accurate, authentic, useful tools to be used in U. S. war effort. Don't wait! Put them to work now!

Without delay, send for full information and free catalogue!

CASTLE FILMS

Distributor for

THE UNITED STATES OFFICE OF EDUCATION

CASTLE FILMS

RCA BLDG. NEW YORK | FIELD BLDG. CHICAGO | RUSS BLDG. SAN FRANCISCO | Address nearest office

Please RUSH full description of THE U. S. OFFICE OF EDUCATION'S films on SHIPBUILDING.

*Name*_____

*Address*_____

*City*_____ *State*_____ AMS

Do you have a METAL FINISHING *Problem?*

DO YOU NEED INFORMATION ON THESE?

★ ★ ELECTROPLATING

★ ★ ANODIZING

★ ★ CLEANING

★ ★ PICKLING

★ ★ POLISHING

★ ★ COLORING

You may have a war material contract calling for plating, anodizing, or special finishing of certain parts.

Tell us about your problem.

We can help you with information—accurate, quick, dependable information on how the job can be best handled.

WE HAVE EXPERIENCED MEN! Our chemists and engineers know their business. They know processes and equipment. Metal finishing problems are their speciality.

WE HAVE EQUIPMENT AND SUPPLIES! Udylite has a complete line of supplies and equipment for plating, anodizing, cleaning, pickling, metal finishing. A few equipment items are shown on the opposite page. Every Udylite product is of the highest quality—designed for dependable, efficient production.

WE CAN WORK FAST! We know you are in a hurry and our organization is geared accordingly. We'll give you information promptly—we can make quick delivery of supplies and equipment. If you plan an expansion or a completely new plant—or want a figure for estimating purposes, let us know about it. We'll be glad to help you.

THE UDYLITE CORPORATION

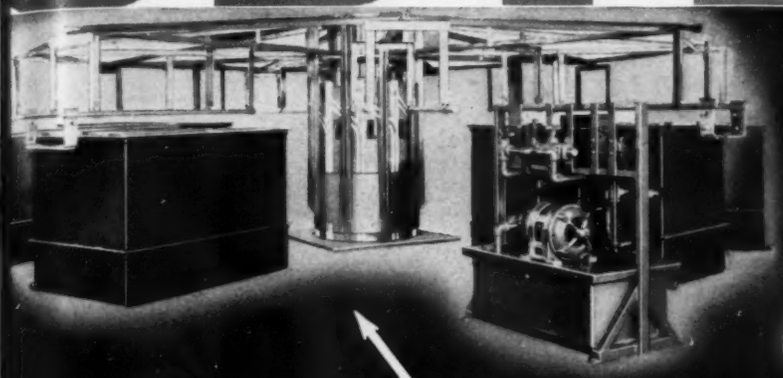
1651 E. Grand Blvd., Detroit, Mich.

Chicago
1943 Walnut Street

Long Island City, N. Y.
11-16, 44th Drive

Cleveland
4408 Carnegie Ave.

UDYLITE



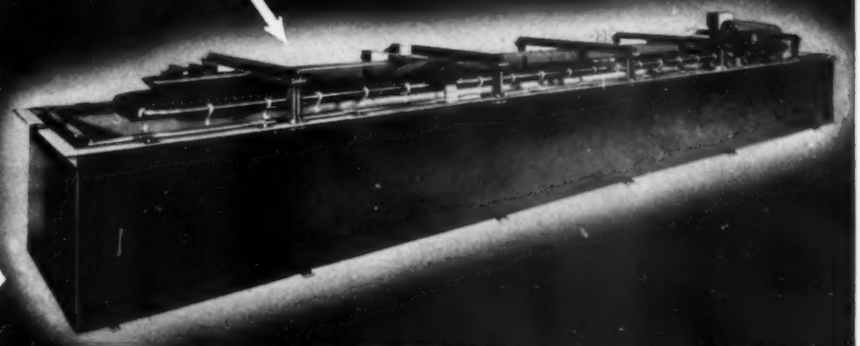
AUTOMATIC BARREL PLATING MACHINE automatically processes large quantities of small parts in bulk, through required cleaning, rinsing, pickling, plating, drying operations. Now used to clean, pickle and oil shell case parts.

ROTARY TYPE, FULL AUTOMATIC CONVEYOR carries racked parts through entire sequence of dipping or immersion operations. Now used for electroplating, special cleaning and pickling, heat treating, anodizing and black finishing.

★

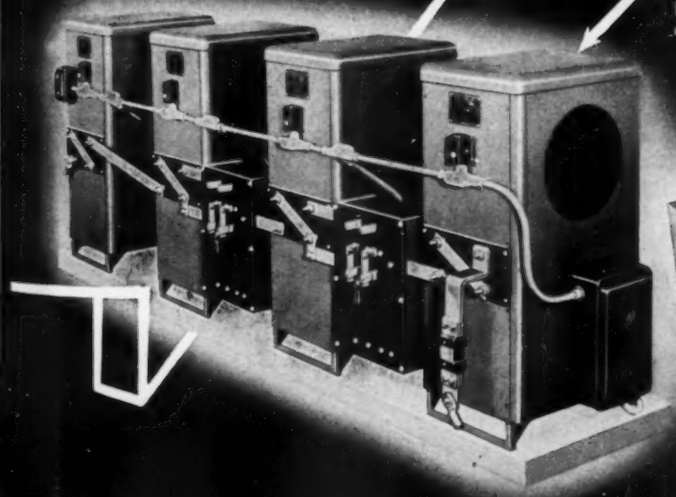
Here are a few typical pieces of Udylite metal finishing equipment which are helping to *SPEED UP* war production. Put them to work for you!

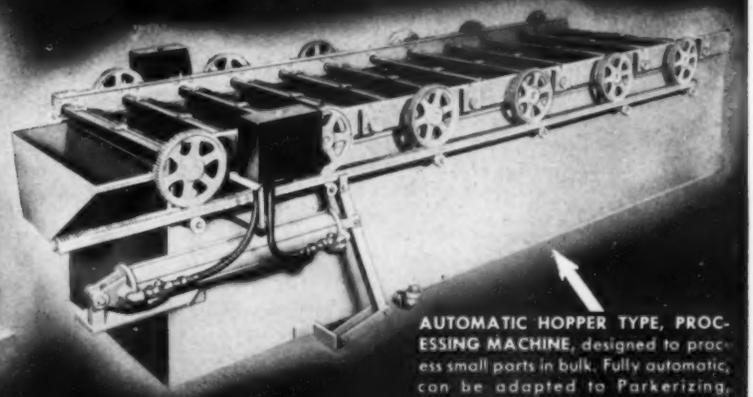
SEMI-AUTOMATIC PLATING CONVEYOR brings plated work to operator who loads and unloads machine at one spot. This machine saves labor, permits close production and process control through regulation of chain drive.



UDYLITE MALLORY RECTOPLATERS—Individual units are rated at 1440 amperes at 6 volts or 720 amperes at 12 volts. Connected in series for anodizing (as shown), total rated output of 720 amperes at 48 volts is obtained. Practically any combination can be furnished to produce the desired plating or anodizing current.

Carried in stock for immediate shipment.





AUTOMATIC HOPPER TYPE, PROCESSING MACHINE, designed to process small parts in bulk. Fully automatic, can be adapted to Parkerizing, black finishing, immersion plating or special dip processes.

SYMBOL OF DEPENDABLE PERFORMANCE IN TOOL STEELS

Coppco water hardening (gray label) and oil hardening (black label) tool steels have been developed from the long experience of our metallurgical engineers and their familiarity with the users' requirements.

"COPPCO .75"

WATER HARDENING GRAY LABEL

Hardens to give greater toughness than Coppco Universal or Coppco 1.10. *Used for:* Shock tools · Extra Large Shear Blades · Swages · Button Sets · Drift Pins · Cold Chisels · Large Hammer Dies · Rivet Busters · Sledges.

"COPPCO UNIVERSAL"

WATER HARDENING GRAY LABEL

Balanced hardness and toughness. Good cold cutting properties. *Used for:* Pneumatic Tools · Large Shear Blades · Punches · Mandrels · Blacksmith Tools · Arbors · Vise Jaws · Dies—*Cold Heading, Trimmer, Heavy Stamping, Drawing, Forming, etc.*

"COPPCO 1.10"

WATER HARDENING GRAY LABEL

Gives maximum hardness. Holds a keen cutting edge. Resists wear. *Used for:* Milling Cutters · Circular Cutters · Woodworking Tools · Fine Shear Blades · Knives · Drills · Arbors · Reamers · Dies —*Embossing, Jewelers, Cold Heading, Threading, etc.*

"COPPCO STANDARD"

OIL HARDENING BLACK LABEL

Non-deforming. Deep-hardening. Wear resistant. *Used for:* Broaches · Milling Cutters · Threading and Tapping Tools · Reamers · Precision Tools · Gauges · Dies —*Blanking, Forming, Extrusion, Stamping, Shearing, Trimming, etc.*

"COPPCO" TOOL STEELS ARE ONE OF THE FAMILY ARISTOLOY STEELS OF ARISTOLOY "SPECIAL QUALITY" STEELS

COPPERWELD STEEL COMPANY WARREN, OHIO

CALL IN A CITIES SERVICE LUBRICATION ENGINEER

A leading manufacturer of oil drilling equipment said recently: "Cutting Oil plays an important part in the machining of sucker rod joints. The materials to be machined are tough, heat-treated forgings of either carbon or alloy steel. Cities Service Cutting Oils — which we have used for many years — have made possible *greater economies* as exemplified by *longer tool life,* more work per tool grind and a very satisfactory degree of finish and accuracy." (Manufacturer's name furnished on request.)

This is one of many examples why Cities Service Metal Cutting Fluids have earned the title, "Service Proved."

We shall welcome an opportunity to tell you about our friendly consultation service. Simply send us the coupon below. There is no obligation, of course.

OIL IS AMMUNITION — USE IT WISELY!

CITIES SERVICE OILS
ONCE-ALWAYS

Write to —
CITIES SERVICE OIL COMPANY
Room 1326, Sixty Wall Tower, N. Y.

or any of the following offices:
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KANSAS CITY · BOSTON · TORONTO

or to
ARKANSAS FUEL OIL COMPANY
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Please send me information concerning your Engineers' Lubrication Service. ☐
Please send me your booklet, "Metal Cutting Lubrication." ☐ A.M.

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City_____ State_____

A LUBRICANT FOR EVERY INDUSTRIAL NEED

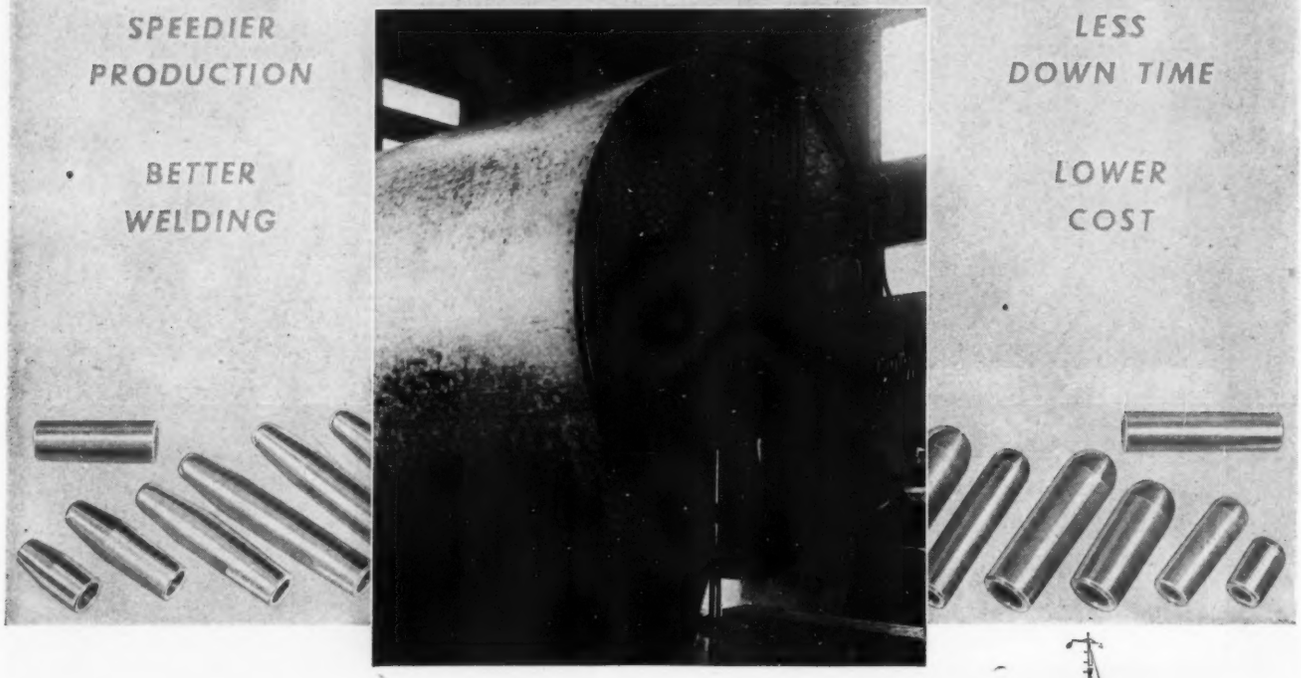
MALLORY STANDARDIZED WELDING ELECTRODES

SPEEDIER PRODUCTION

BETTER WELDING

LESS DOWN TIME

LOWER COST



Resistance Welding Speeds Smoke Stacks for the Navy!

Resistance welding . . . already used on a large scale in building naval aircraft . . . has also speeded up the fabrication of light gauge warship assemblies for the U.S. Navy.

For instance, at the Philadelphia Navy Yard, smoke stacks for naval ships are now fabricated more rapidly and economically by spot and seam welding than by the previous method of riveting. Smoke stacks of cylindrical or elliptical shape, 25-40 ft. high and 8-14 ft. in diameter, are speedily assembled from galvanized steel or stainless steel sheets, 0.032-0.096 in. thick, stiffened by flat bars, angles or channels welded circumferentially or longitudinally to the stack interiors.

Pedestal type press welders, portable guns for inaccessible spots both ashore and aboard ship, and a seam welder comprise the Philadelphia Navy Yard's resistance welding equipment. Spot welding tips and holders, as well as seam welding rolls, represent Mallory's contribution to the increased speed and economy of this particular naval assembly job.

Mallory Standardized Resistance Welding Electrodes are used for important wartime applications because welding engineers have learned to depend on Mallory for resistance welding electrodes that produce more welds between redressings . . . assure a higher total of welds before replacement is necessary . . . and provide stronger, cleaner welds at lower cost.

Mallory's reputation among military and industrial welding engineers, foremen and welders rests on the solid foundation of long-continued Mallory research . . . that has developed special alloys, electrode designs and cooling methods . . . and that has culminated in our unique standardization program. Because of Mallory standardization, you can get the resistance welding electrodes and holders you need *promptly*, when and where you need them.

MALLORY Resistance Welding Data Book

Be sure your engineering files include this factual, complete treatise on resistance welding practices, alloys and specifications. Write for your free copy today.

P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA • *Cable Address*—PELMALLO

RESISTANCE WELDING

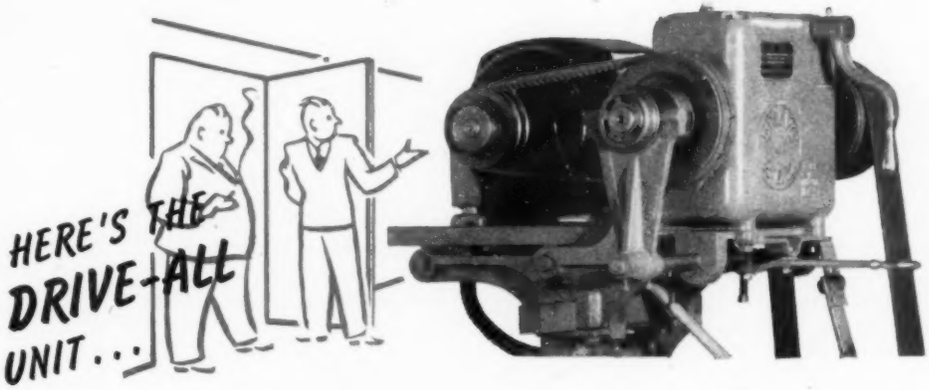
P.R. MALLORY & CO. Inc.
MALLORY

STANDARDIZED ELECTRODES

Would you spend 2 hours and $185 to DOUBLE the production of a Machine Tool?

"Our engine lathes formerly operated at from 300 to 320 R.P.M. These speeds have been doubled and in two cases are running 700 R.P.M. In addition, the units' added pulling power over the belt and cone method has enabled us to increase cutting feeds from .004/.006 to .015/.036. These speeds with the proper cutting tools have doubled our lathe production."

(Letter in our files. Name on request)



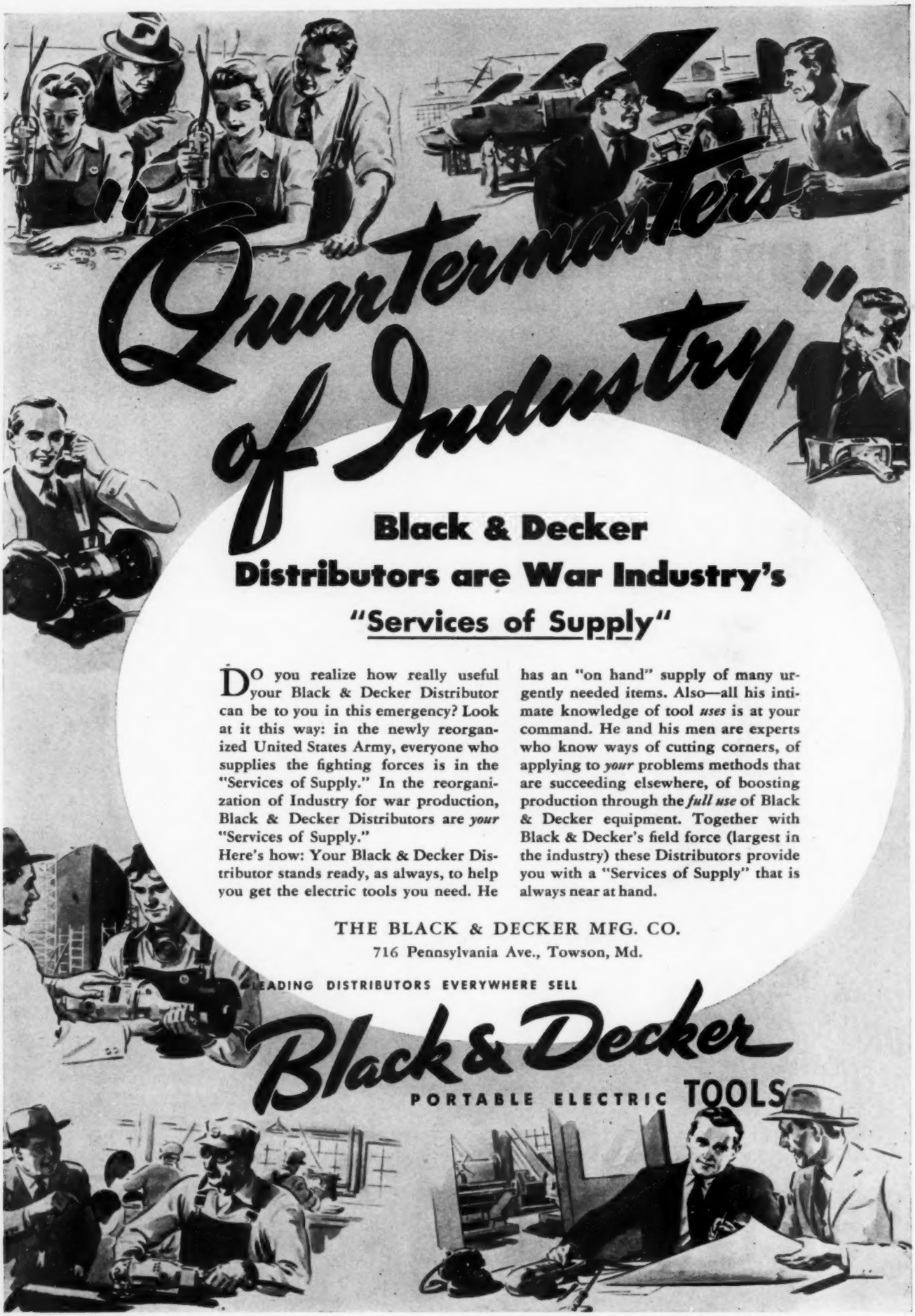
A selective speed motorizing unit that can be installed in approximately 2 hours. Available as Standard Unit, 1 to 5 h.p. and as Heavy Duty 5 to 10 h.p. Both with 3- or 4-speed gear boxes. The Drive-All installation cost in the above typical case totalled about $185, including all necessary electrical equipment. Drive-All prices begin well below this, depending on application.

- ☐ LATHES AND TURRET LATHES
- ☐ MILLING MACHINES
- ☐ GEAR CUTTERS
- ☐ DRILL PRESSES AND RADIALS
- ☐ AUTOMATICS
- ☐ SHAPERS AND PLANERS
- ☐ TAPPERS
- ☐ BORING MILLS
- ☐ SPECIAL APPLICATIONS

This may be just the solution to *your* production problems, too. Write for Drive-All Bulletin and address of your local representative. We will gladly study your requirements without obligation.

DRIVE-ALL MANUFACTURING COMPANY

3403 CONNER AVENUE — DETROIT, MICHIGAN



Black & Decker Distributors are War Industry's "Services of Supply"

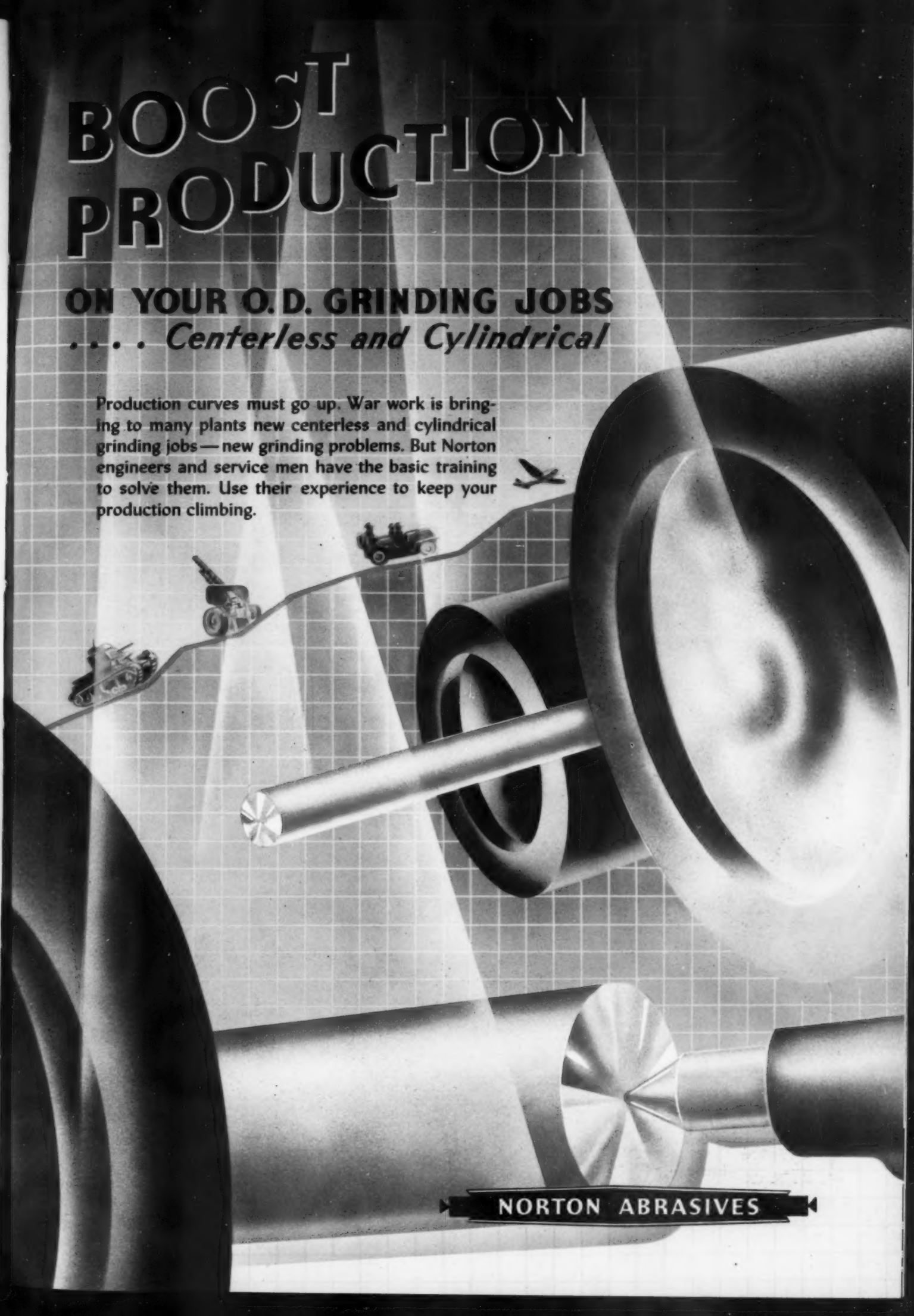
DO you realize how really useful your Black & Decker Distributor can be to you in this emergency? Look at it this way: in the newly reorganized United States Army, everyone who supplies the fighting forces is in the "Services of Supply." In the reorganization of Industry for war production, Black & Decker Distributors are *your* "Services of Supply."

Here's how: Your Black & Decker Distributor stands ready, as always, to help you get the electric tools you need. He has an "on hand" supply of many urgently needed items. Also—all his intimate knowledge of tool *uses* is at your command. He and his men are experts who know ways of cutting corners, of applying to *your* problems methods that are succeeding elsewhere, of boosting production through the *full use* of Black & Decker equipment. Together with Black & Decker's field force (largest in the industry) these Distributors provide you with a "Services of Supply" that is always near at hand.

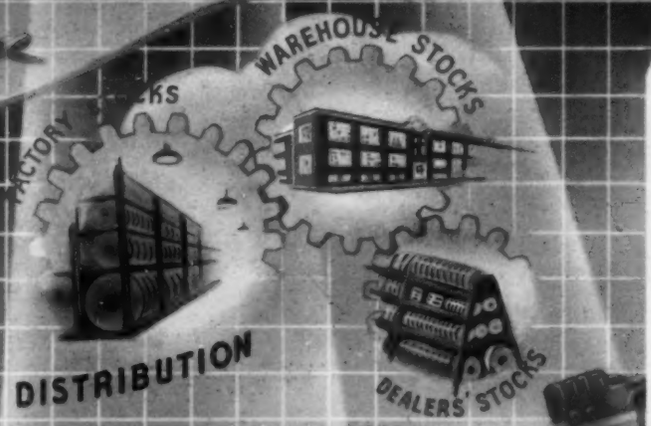
THE BLACK & DECKER MFG. CO.
716 Pennsylvania Ave., Towson, Md.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker
PORTABLE ELECTRIC TOOLS


BOOST PRODUCTION
ON YOUR O.D. GRINDING JOBS
. . . . Centerless and Cylindrical
Production curves must go up. War work is bringing to many plants new centerless and cylindrical grinding jobs — new grinding problems. But Norton engineers and service men have the basic training to solve them. Use their experience to keep your production climbing.
NORTON ABRASIVES

NORTON SERVICE
for Victory Production



Local Distributors to Help You Out of the Tight Spots

Over 160 Norton distributors the country over are aiding the war industries —are ready with grinding wheels on their shelves to meet local needs. Backing them are Norton warehouses in five strategic industrial centers and the Worcester factory stock rooms with over 2,000,000 wheels in some 100,000 combinations.

Engineering Service for the New Grinding Jobs

New grinding problems arise every day as plants change speedily from regular products to war products. But 1800 distributors' representatives, coöperating with Norton field men and factory specialists, are ready to help find the answer. At their command is the wealth of data on grinding in the war industries compiled at Worcester—sent in by Norton field men everywhere for mutual use.

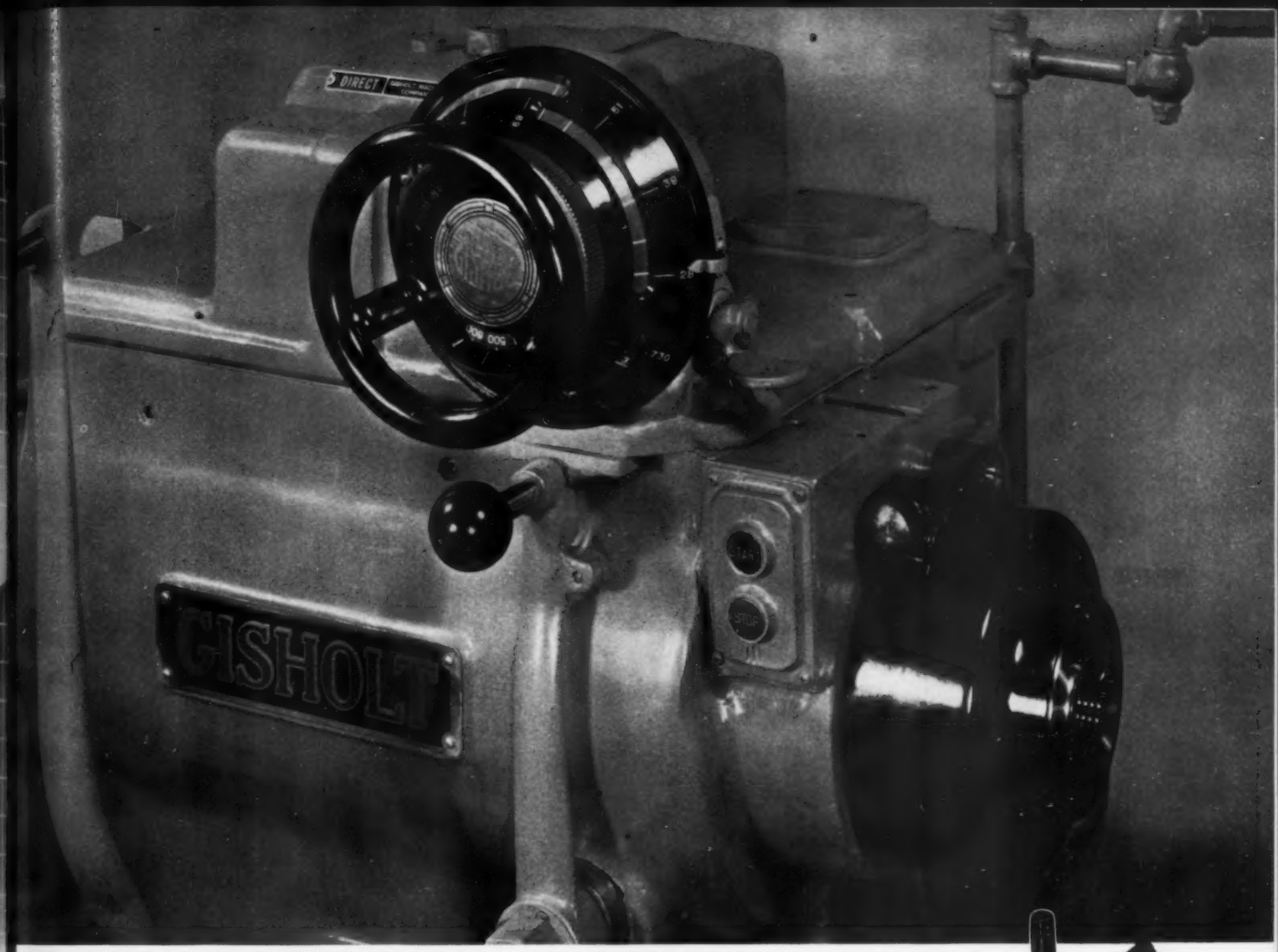
Research Facilities for the Tough Grinding Problems

The Norton research staff has over 50 trained scientists and technicians. A major duty today is to aid the Norton engineering force in solving many of the more difficult grinding problems that new war production jobs have brought. Extensive tests are carried out in both the field and the laboratories to determine the proper wheels and the correct grinding procedure.

NORTON COMPANY
Worcester, Mass.

The Navy "E" flies over the Norton Plants

NORTON ABRASIVES



SPEED SELECTOR DIALS, HANDWHEELS and COLLET CHUCK GUARDS

NEW Plastics Development by Eclipse

Saves Man-Hours and Production Time for Machine Tool Builders . . .

Another FIRST by Eclipse, these new Plastic developments in HEAVY MACHINE TOOL PARTS are saving valuable Wartime machining, finishing and assembly costs — reducing man-hours-per-machine to help Machine Tool Builders meet Government demands for MORE PRODUCTION SPEED.

It takes engineering imagination to design these parts in PLASTICS, and Eclipse does it again — improving Machine Tool efficiency, convenience, and appearance.

The EXTRA advantage of Improved READABILITY is demonstrated in the Gisholt Machine Co. Plastic Speed Selector Dials, above, made by Eclipse Moulded Products Co. Improved READABILITY is achieved easily by *color contrast*, moulding the inner Dial of RED Plastic with White markings, and the outer Dial of BLACK Plastic with White markings. Distinctly superior to the all-metal dials, these contrasting plastic dials and markings enable even inexperienced hands to produce accurate work — faster.

High-Impact Plastic is used and no machining is required before assembly.

Eclipse Plastic Handwheels, used on Gisholt Saddle-Type Lathes have a specific gravity 1/5 lighter than aluminum, and show definite advantages over former metal parts . . . advantages that may be adapted to a wide variety of modern Machine Tools. Dies for these precision built handwheels were made on a Gorton Super-Speed Mill.

Machine Designers and Engineers!

Eclipse Engineers will be glad to assist in your conversion and engineering problems.

For Suggestions and Quotations on your parts send sample or blueprint.

Eclipse MOULDED PRODUCTS CO.

5151 NO. THIRTY-SECOND ST. MILWAUKEE, WIS

CHICAGO — DETROIT — NEW YORK — CLEVELAND — ST. LOUIS

COMPRESSION . . . INJECTION . . . EXTRUSION

RESINOX • TENITE • PLASKON • DUREZ • LUCITE • BEETLE

BAKELITE • LUMARITH • POLYSTYRENE...and all other materials

Some ways to conserve Tool Steel

TEN TIPS ON HARDENING

Tool steel is a weapon. Don't waste it. Every pound of tool steel is urgently needed for work on airplane engines, guns, tanks, ships, and thousands of other war-production jobs. You can help yourself and your country by coaxing the last ounce of service out of every piece of tool steel you use.

The suggestions given here on how to harden tool steel have been tried and proved. By following them, you can cut down spoilage and turn out tools which do a thoroughly efficient job.

1. Heat all grades of tool steel *slowly* and *uniformly* for hardening.

2. Steels requiring a hardening temperature above 2000 deg. F., should be preheated in a separate furnace to 1600 or 1650 deg. F., then brought rapidly to the hardening temperature in the hardening furnace. Steels requiring a hardening temperature of 1700 to 1900 deg. F., should be preheated to between 1400 and 1450 deg. F. Steels having lower hardening temperatures should be preheated to about 1200 deg. F.

3. Do not heat tool steel higher than the correct hardening temperature, or hold too long at hardening temperature. These practices are likely to burn the steel or produce grain growth. Use the lowest temperature which will effectively harden the tool.

4. Use the lower part of the recommended quenching range when hardening small or intricately shaped part. Use the higher part of the range on large parts.

5. The use of salt or lead baths reduces the required heating time by about one half. Always warm a tool before immersing it in such a bath.

6. When hardening differentially, don't leave a sharp line of demarcation between hardened and unhardened portions. Let the hardness merge gradually. Arrange the quenching apparatus so that a uniformly strong flow of quenching medium washes over the portion to be most deeply hardened.

7. During hardening, tool steel changes its volume. This change sets up stresses which may cause breakage unless relieved. Therefore, start tempering immediately after the hardening operation, before the part has cooled to room temperature.

8. Do not reharden tools without first giving them a stress-relieving treatment.

9. If you want to protect the surface of the steel against decarburization in hardening, pack-harden it in cast-iron chips, sand, coke breeze or some other suitable material.

10. Regardless of whether or not your shop is equipped with pyrometer control, it is advisable to determine the best hardening temperature for the particular tool steel you are using. This may be done by hardening small specimens from temperatures above, below, and at the temperature which is recommended. The specimens should be nicked before hardening. After hardening they should be broken at the nick. A study of the fractures will quickly show the correct temperature or range of temperatures required to produce the best grain refinement.

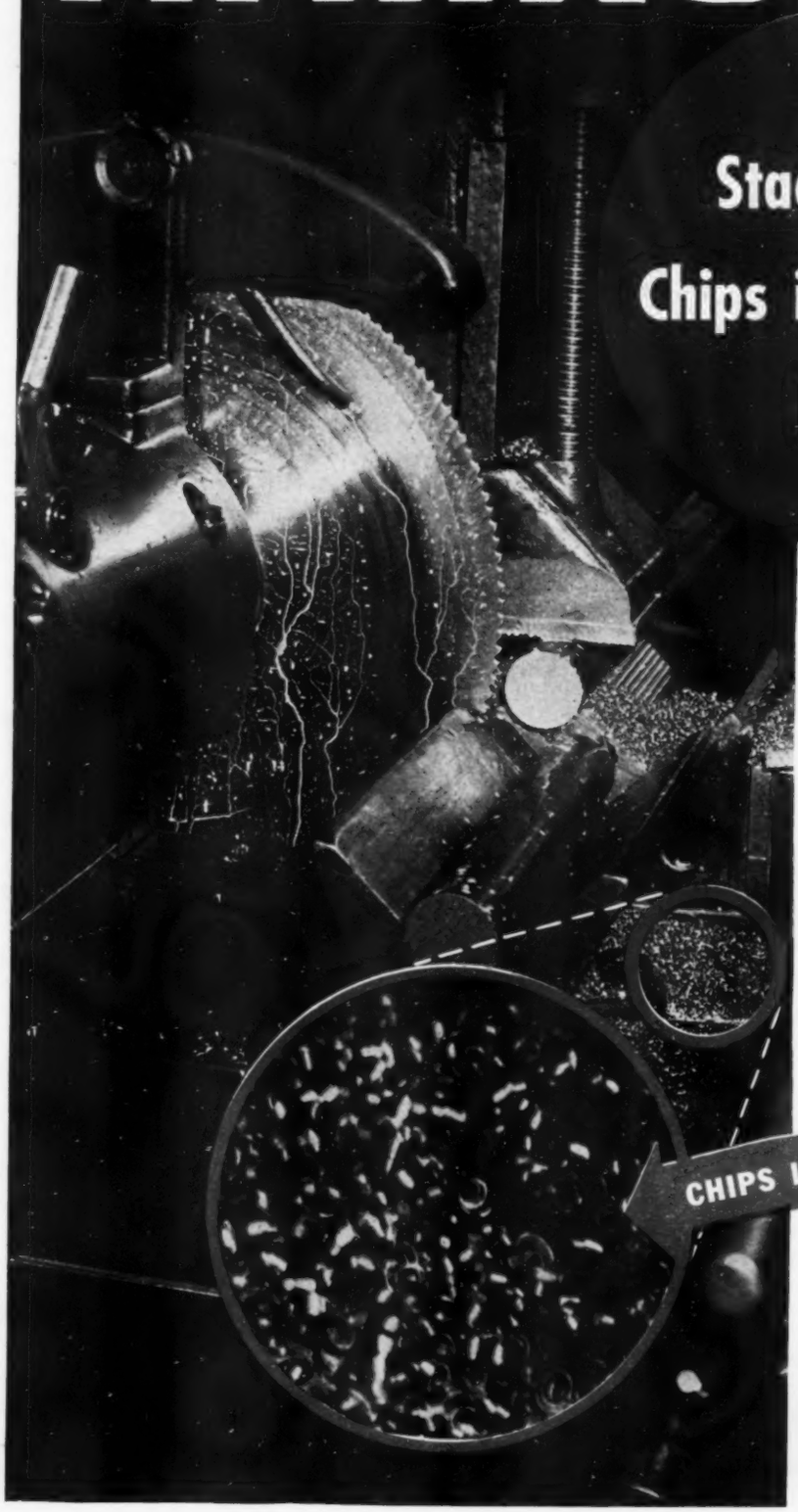
The correct hardness range can also be determined by taking hardness readings on the hardened pieces. As soon as the proper range is approached, a rapid increase in hardness will result. By combining the two methods, you can get complete information on the steel.

This information is available in the form of a card suitable for hanging in shop or office. No cost or obligation. Write to Bethlehem Steel Company, Bethlehem, Pa.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

ATKINS *Curled Chip* SAWS ★★★



Stacking the Chips in America's Favor

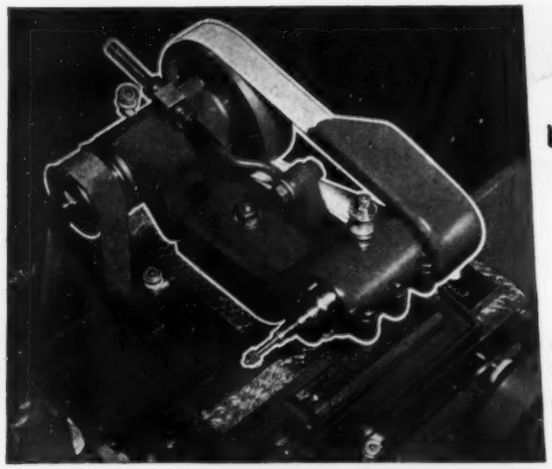
● When the chips produced by metal cutting saws shoot out like suddenly released clocksprings, it is a sure sign that material is being cut at an exceptionally high rate of speed. It is a sign that the shop or plant has put metal cutting on an all-out wartime basis and is meeting the need for utmost production on a vital part of its operations.

On a wide variety of armament materials, Atkins Curled-Chip Saws are turning in exceptional performance records . . . permitting the operation of modern heavy-duty power saw machines at maximum speeds . . . cutting more square inches of metal per minute . . . operating continuously for long periods without grinding . . . helping to "stack the chips" in this Nation's favor.

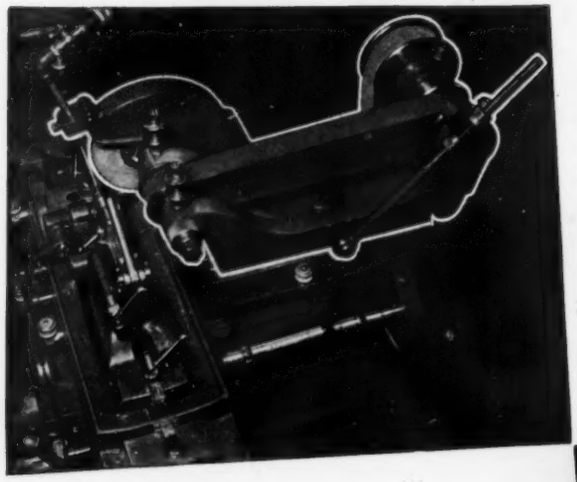
CHIPS LIKE THESE ARE HELPING WIN!

This close-up is an unretouched enlargement of a small section of the large photograph. It shows the metal chips removed by an Atkins Segmental Cold Saw, just as they accumulated on a part of the machine. Notice the unique coiled shape of the chips—the result of the scientific cutting action of Atkins Curled-Chip Teeth with large sized gullets and an inward curved cutting face. This type of tooth is available on Segmental Cold Saws, Circular Milling Saws, Power Hacksaw Blades and Band Saws.

E. C. ATKINS AND COMPANY
424 S. Illinois St. Indianapolis, Ind.



Internal-External Grinding



INTERNAL GRINDING

Internal spindle is driven by belt from main drive motor, as shown at left above, at speeds up to 35,000 r.p.m. Holes from the smallest up to 3" diameter can be ground with maximum 4" power or 11" hand table reciprocation.

EXTERNAL GRINDING

External grinding attachment readily interchanges with internal spindle bracket on the cross slide, as shown at left, and is used for grinding straight and taper diameters or bevels. A wheel up to 6" maximum diameter by 1/2" face can be used.

RIVETT No. 104 GRINDER

is designed to meet the demand for a small grinder suitable for precision tool making and accurate manufacturing. It may be used as a single-purpose production machine or for the many internal and external grinding requirements of the tool room. Its ease of set-up and wide range of adjustment make it more economical on small lots of parts than a heavier machine.

Although primarily an internal grinder, an external grinding attachment is offered to interchange with the internal spindle bracket. The Rivett fixed diamond is used both for truing either internal or external wheels and for maintaining sizes on duplicate work. For further information write for bulletin 104-C.

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.

Some time you will change to

MO-MAX

TRADE MARK REG. U.S. PAT. OFF.

HIGH SPEED STEEL

Why not now?

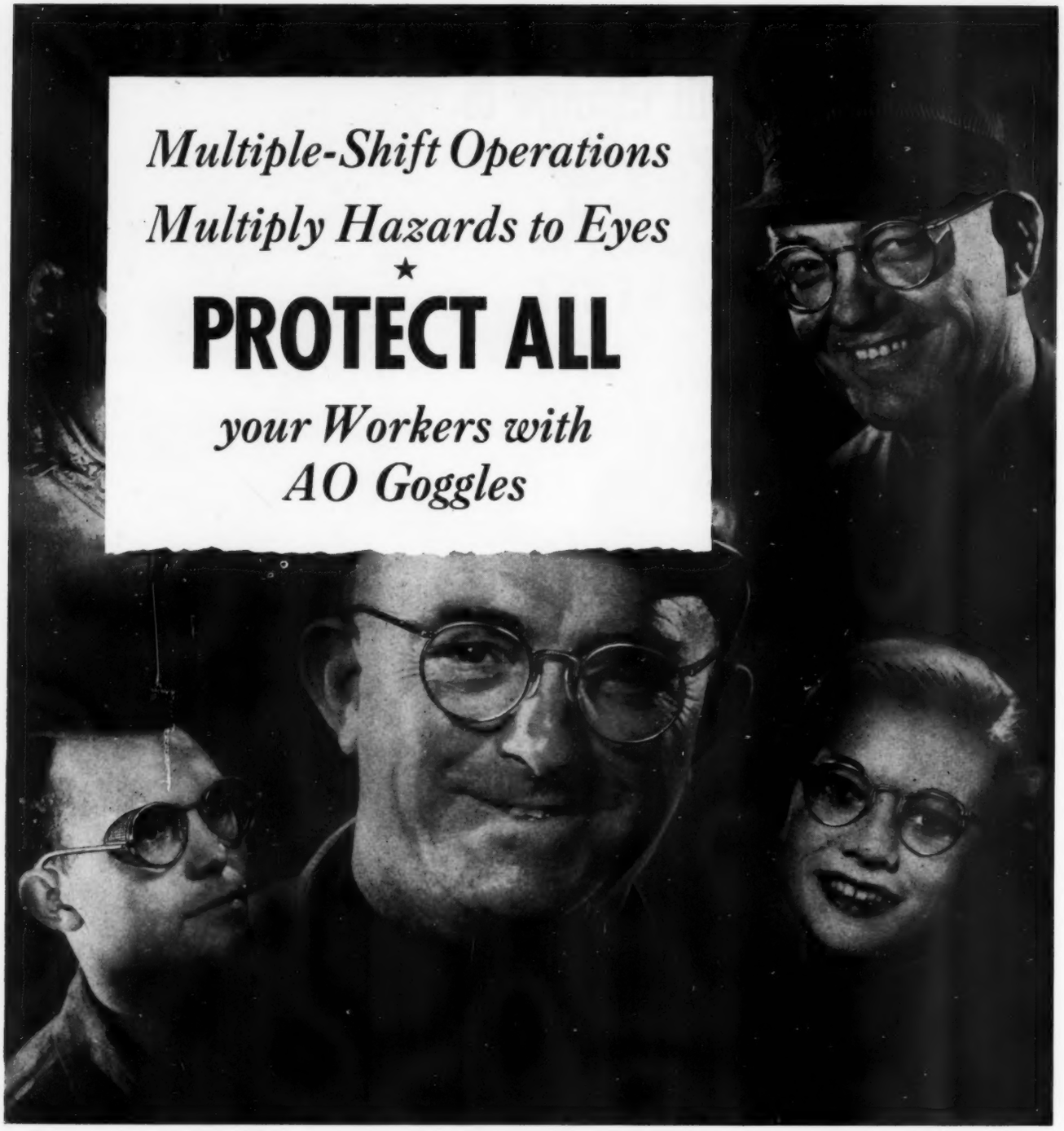
It is believed that MO-MAX is now in the best strategic position of all high speed steels • Its moly is produced within our borders • So is the less than 2% of tungsten required • The vanadium is only 1%, the lowest in any commercial high speed steel • Its economy is outstanding • Its cutting quality is 20% better than 18-4-1 • It has been commercially established for more than nine years • Change now to the ultimate high speed steel • Fourteen high speed steel makers manufacture brands of MO-MAX and make it readily available.

For Technical Data Booklet

Write any of the steel makers listed or to The Cleveland Twist Drill Co., Cleveland, Ohio.

LMW Alleghany Ludlum Steel Co.	DI-MOL Henry Disston & Sons, Inc.
MOHICAN Atlas Steels, Ltd.	REX TMO Halcomb Steel Division Crucible Steel Co. of America
BETHLEHEM HM Bethlehem Steel Company	MOGUL Jessop Steel Company
MO-CUT Braeburn Alloy Steel Corp.	TATMO Latrobe Electric Steel Co.
STAR MAX Carpenter Steel Co.	S.T.M. Simonds Saw and Steel Co.
MOLITE 8 Columbia Tool Steel Company	MO-TUNG Universal-Cyclops Steel Corp.
REX TMO Crucible Steel Co. of America	VUL-MO Vulcan Crucible Steel Co.

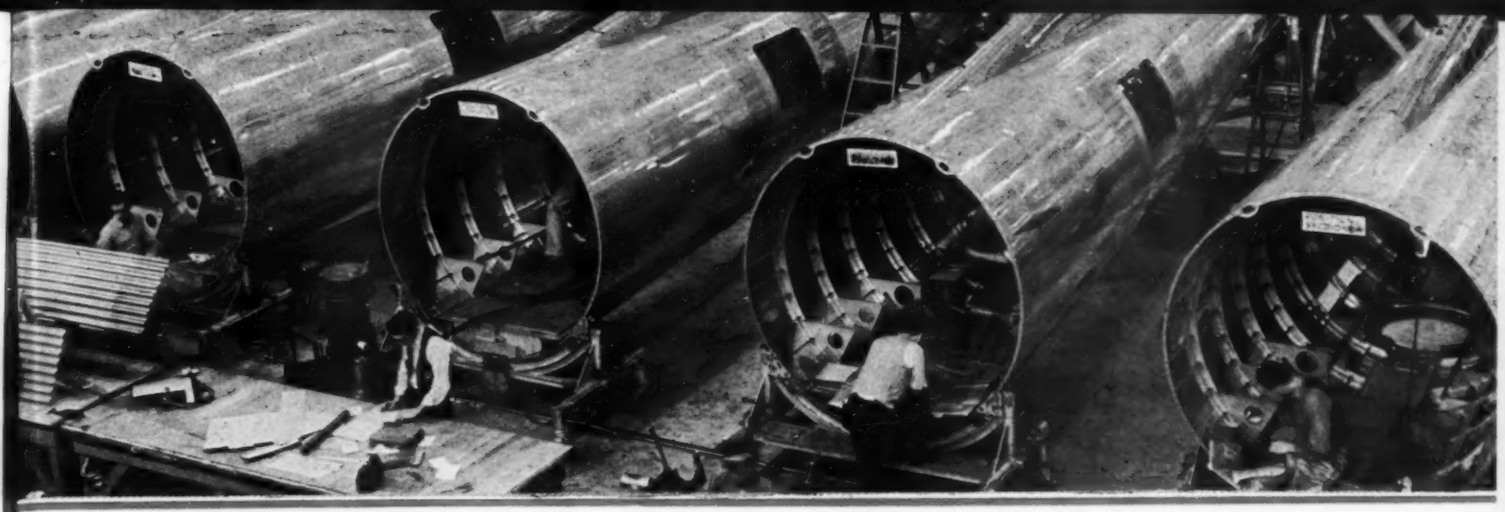
2301



Remember this: as the size of a working force increases, the possibility of eye accidents increases. Eye protection must keep step with employment. All workers, especially *new* and *inexperienced* ones should be given the right type of goggles for their work.

Put a complete eye protection program in your plant *now*. American Optical Company can help you — with a complete line of safe, comfortable goggles and cooperation to make your eye safety program effective.

THE American Optical COMPANY
SOUTHBRIDGE MASSACHUSETTS



COMING IN JULY...

War Production Number of AVIATION

TO HELP THE MEN WHO ARE BUILDING THE 185,000 FIGHTING PLANES CALLED FOR BY THE PRESIDENT

Production miracles are being performed in America's fastest-growing industry. New methods, new techniques, new tools, new machinery are being developed almost daily. AVIATION, the business magazine of the industry, brings to the builders of America's giant Air Force an authoritative exchange of the latest production advancements. In July the Annual Production Number of AVIATION will present an up-to-the-minute round-up of all phases of major production methods . . . THE WAR PRODUCTION NUMBER OF AVIATION.

AVIATION TALKS THE LANGUAGE OF THE MEN WHOSE SLEEVES ARE ROLLED TO DO AMERICA'S BIGGEST WARTIME JOB . . .

Their language is PRODUCTION. They look to *Aviation* to learn faster ways of turning out their products, better methods of fabrication, simpler ways to handle complex operations.

If your products or services can help aviation men lick their problems—tell it in *Aviation*. If you can help these men build more planes faster — or better — or with less manpower — or with fewer machines — or increase man-hour efficiency — tell your story in *Aviation*. You'll get an interested hearing from men who want help—who need all the help you can give them.

REACH THE BUYING POWER OF THE INDUSTRY WITH AVIATION . . .

America's oldest aeronautical magazine has always been edited for the men who design and build our air strength. Current net paid circulation of 41,000 embraces thorough coverage of the industry's buying power—the executives, engineers, designers, and production officials of the manufacturing branch, the Army and Navy, the airlines—all of primary importance.

Aviation's circulation is selected with rifle-shot accuracy to give you complete and effective industry coverage. In aviation and subcontracting plants throughout the country key men are carefully identified, located and rated.

With *Aviation*, it's *who — not how many.*

Editorial Highlights telling the story of "How Mass-production Methods are being applied to Aviation Production"

How the Aircraft Engine Industry has stepped up production many times over.

•

Mass-producing one of the world's fastest fighters.

•

Production control miracle—done with cards.

•

How one of our Industrial Giants is gearing up to mass-produce fighter power-plants.

•

Mass-production methods applied to Airframe Assembly.

•

Story of a revolutionary new "forming-by-drawing" process for sheet metals.

•

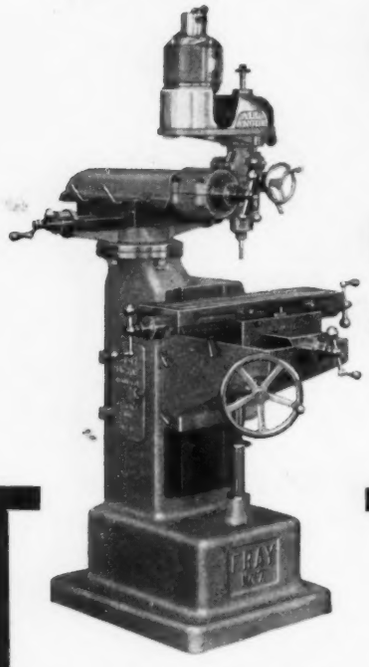
How substitute materials are opening up bottle-necks.

Aviation Magazine ★ A McGraw-Hill Publication ★ 330 West 42nd Street, New York, N. Y.

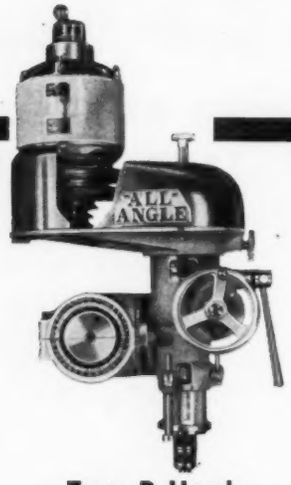
All the Flexibility of a Rubber Hose

FRAY

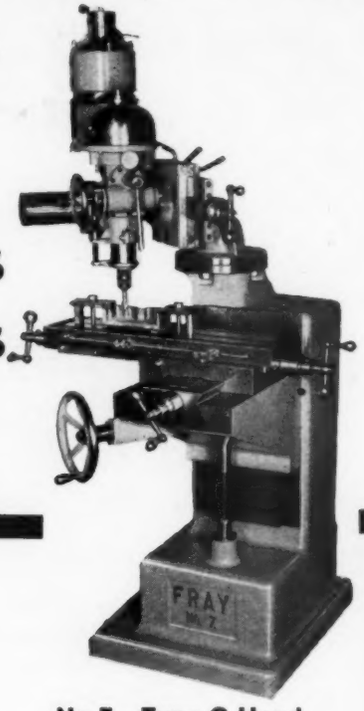
"All-Angle" Milling Machines and Attachments



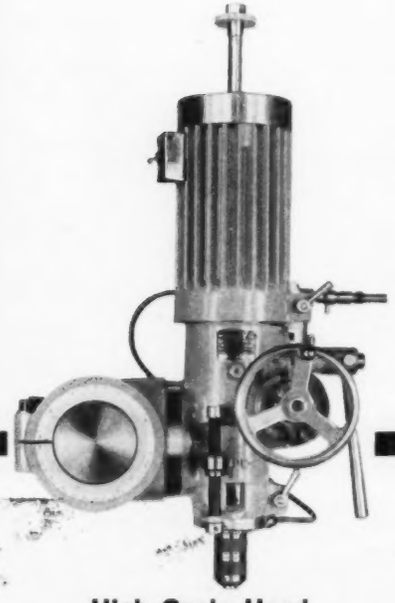
No 7-B Ram Type
Cross movement of Head above work — as well as longitudinal movement — gives complete range of operations with *one set-up.*



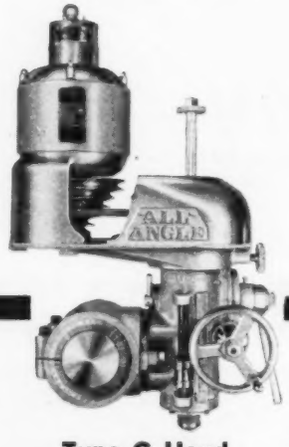
Type D Head
Motor swings completely around housing and can be locked at any point. Micrometer wheel feed or hand feed. Positive quill lock.



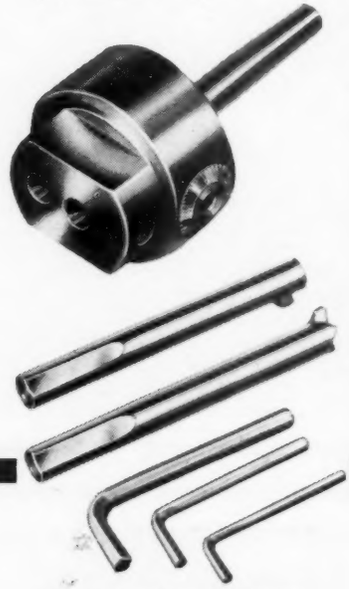
No 7—Type C Head
Full universal, quill type machine. . . . Hand wheel feed calibrated in 1/1000". Hand lever feed, micrometer depth stop, clear vision graduations on quill.



High Cycle Head
For high speed production on Dural and Aluminum Alloys . . . cutter speeds as high as 10,000 lineal feet per minute. Adapted to Types A. B and C Heads.



Type C Head
Complete with FRAY Heavy Duty ½ H.P. 3-phase, 220 V, 50/60 cycle motor, 1 collet for ½" straight shank end mills. Spindle No. 7 Brown & Sharp, Alemite grease gun and wrench.



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Standard—body diameter 3", offsets 1¼". Micrometer, 50 divisions of .001". Also available in Junior Model, 2" body diameter — Complete with boring bars and wrenches.

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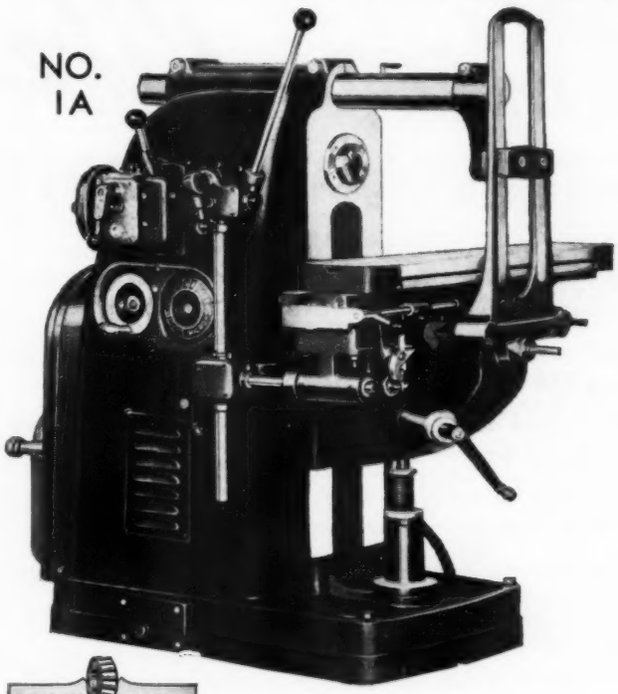
WITH *MICRO-SPEED DRIVE*

NO. 1A



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The table is supported on extra long double V-slides cast in the saddle and is provided with adjustable aligning gibs to compensate for wear. Positive automatic longitudinal power feed supplied to the table. All feeds provided with adjustable dials graduated to thousandths of an inch.

- **SELECTOR DIAL CONTROL**
- **SPINDLE BRAKE and CLUTCH**

Here's the ideal milling machine for small parts production. The Micro-Speed Unit, mounted inside the streamlined column (as shown in inset) provides the operator with a wide range of spindle speeds. Selector Dial Control selects the desired speed instantly, at the turn of the handwheel adjacent to the dial on the column. All Controls on One Side of Machine for Easy Access.

SPEEDS	RANGE OF FEEDS
56 to 630 R.P.M. Equipped With Spindle Brake	Longitudinal, 34"; Cross, 8"; Vertical, 18½"

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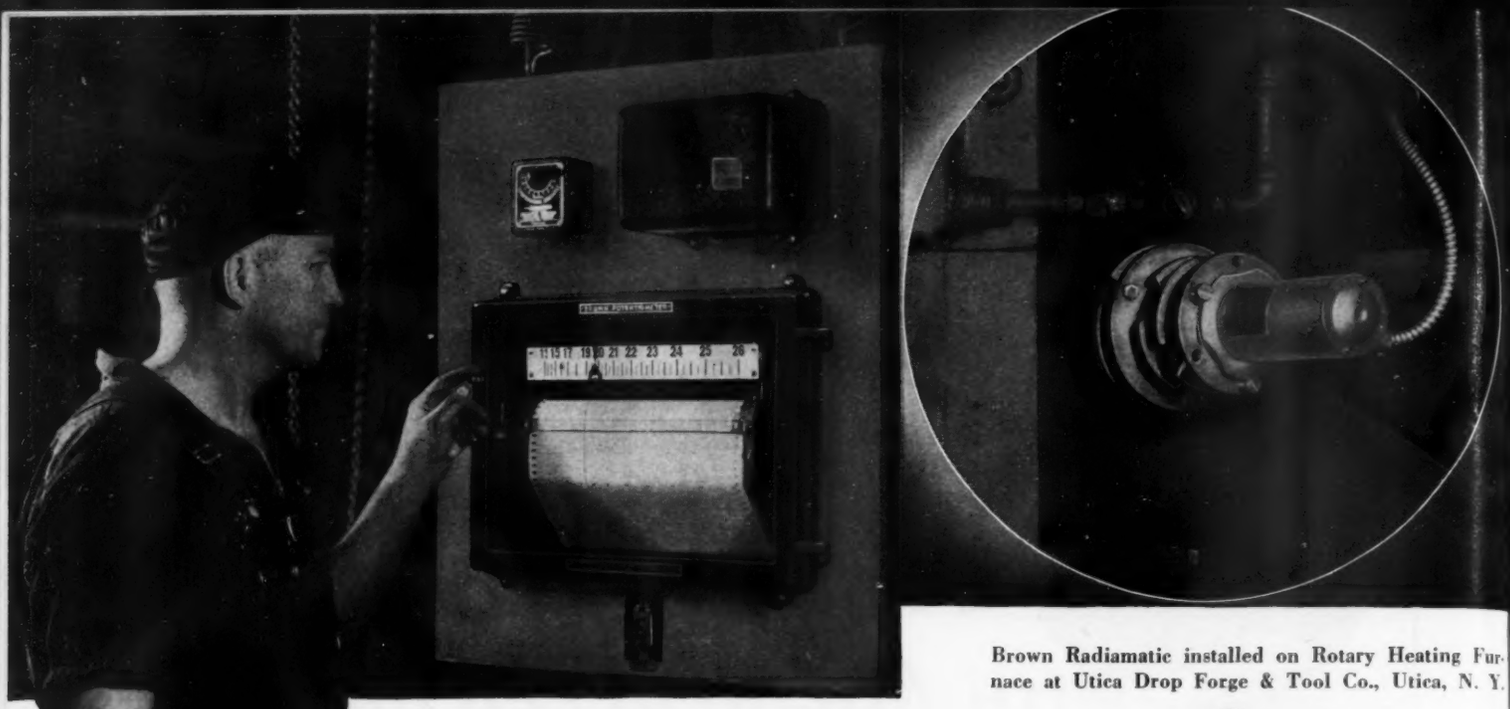

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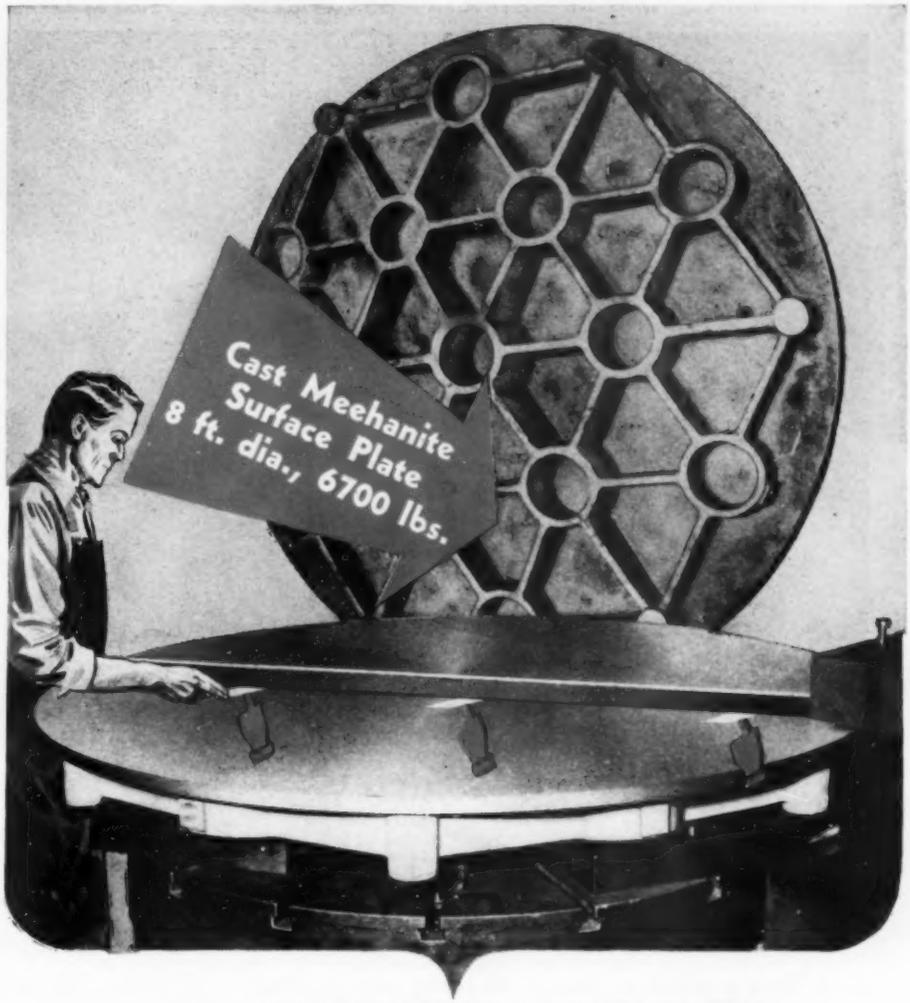

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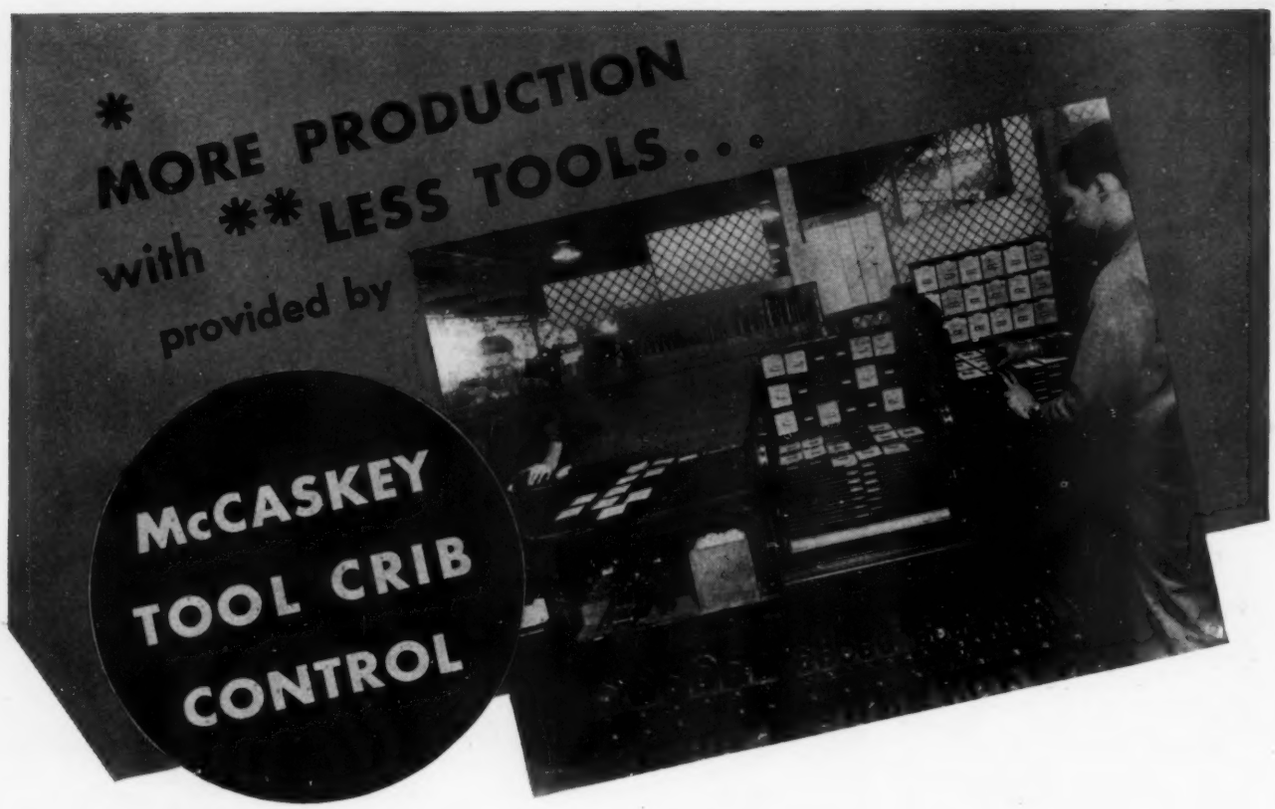
Write for this Engineering Booklet, Bulletin No. 13-- "Meehanite in Industry."



* LOST MINUTES TURNED INTO PRODUCTIVE HOURS

The line of two or three or more employees waiting at the crib window to draw and return tools represents a loss of production that is entirely unnecessary. McCaskey Control enables attendants—even the inexperienced ones used in so many plants today—to locate tools without delay whether in the crib or out on the production floor, to record each transaction and to quickly serve everyone without arguments about responsibility for tools loaned or returned.

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McCaskey Control prevents employees from hoarding tools that should be in the crib available for use. Many "lost" tools simply are out-of-sight in some employee's tool box or under his machine. McCaskey fixes responsibility for each tool loaned to each employee, indicating in a moment how many he has and how long each tool has been out. Tools are kept in circulation and inventories are reduced. Loss and theft are eliminated and breakage invariably is cut from twenty-five to fifty percent. Investigate these and numerous other savings available thru McCaskey for a surprising low investment.

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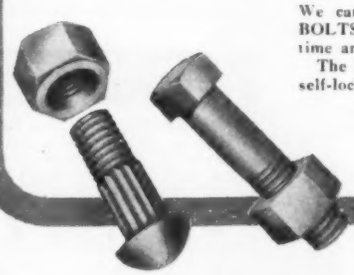

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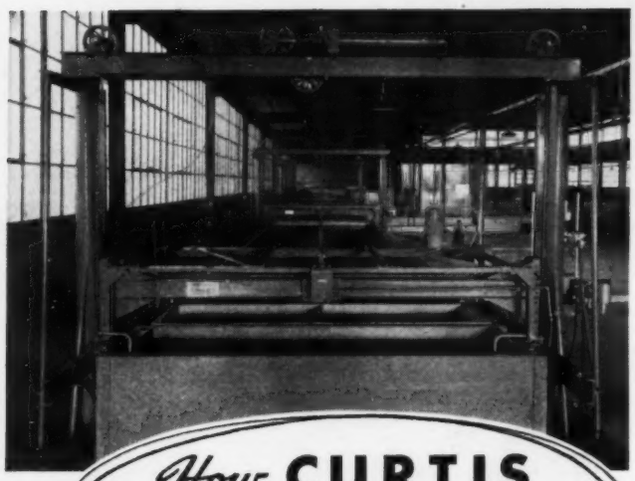

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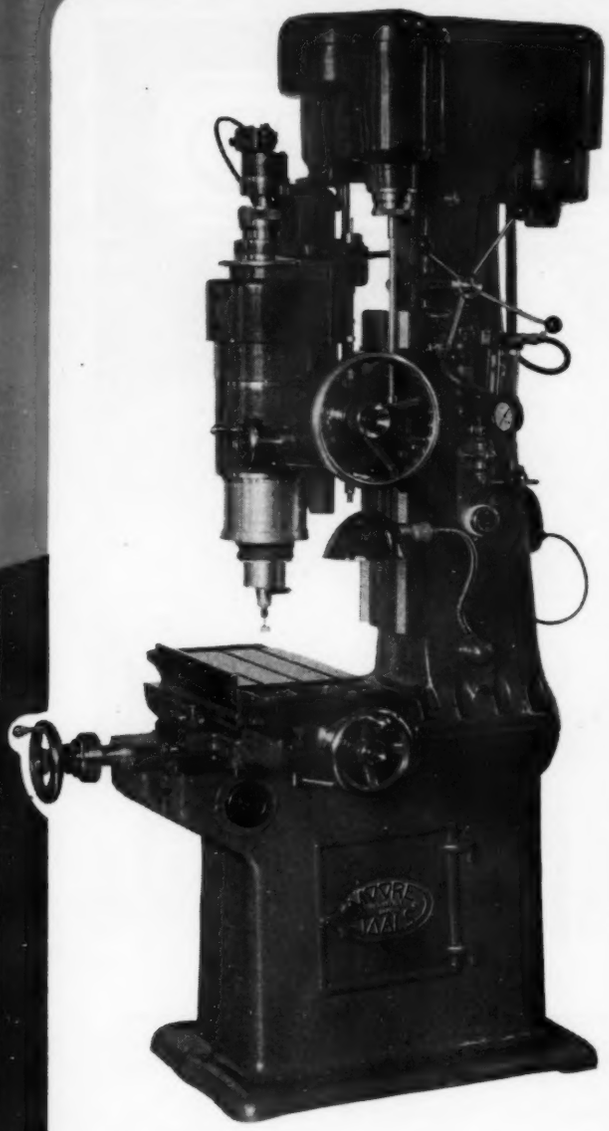

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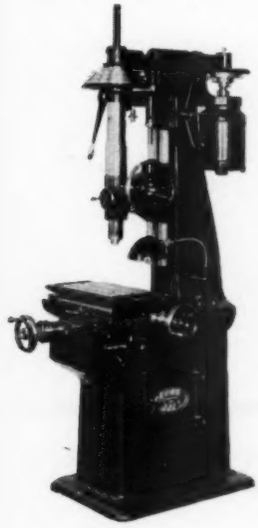

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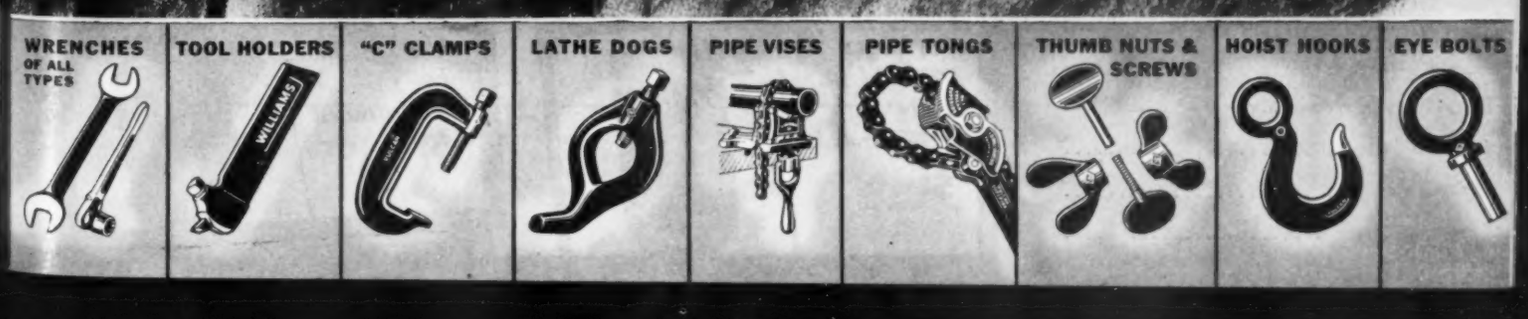

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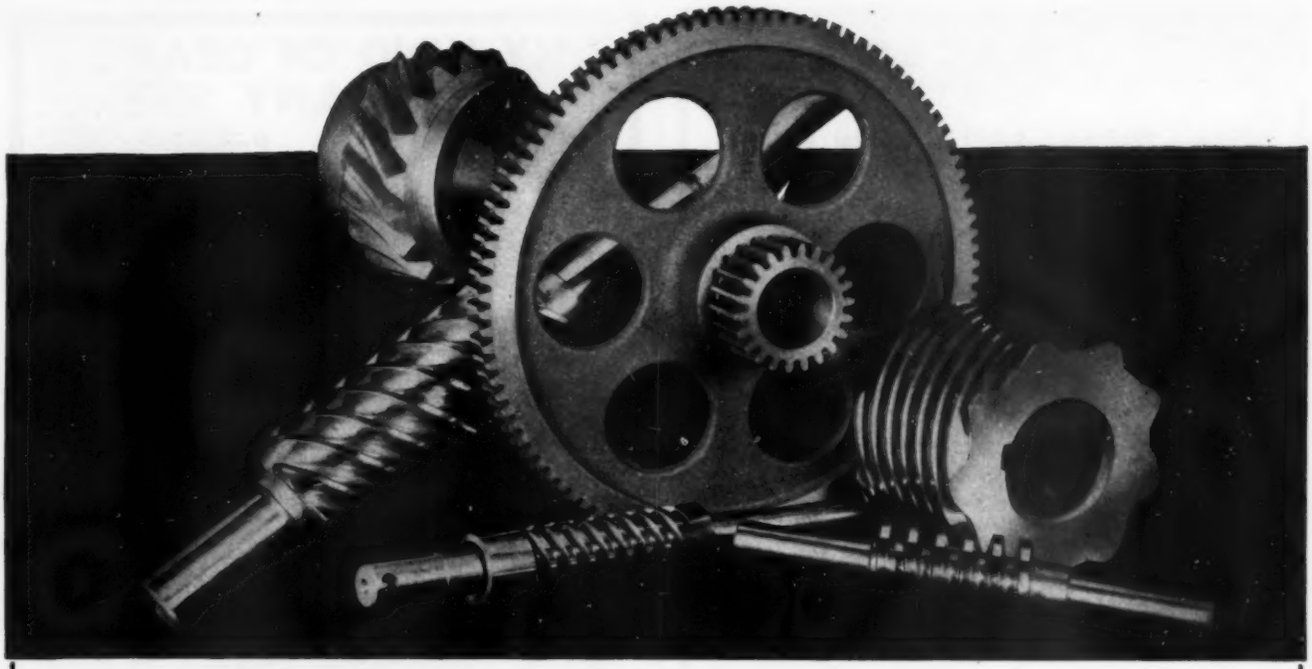

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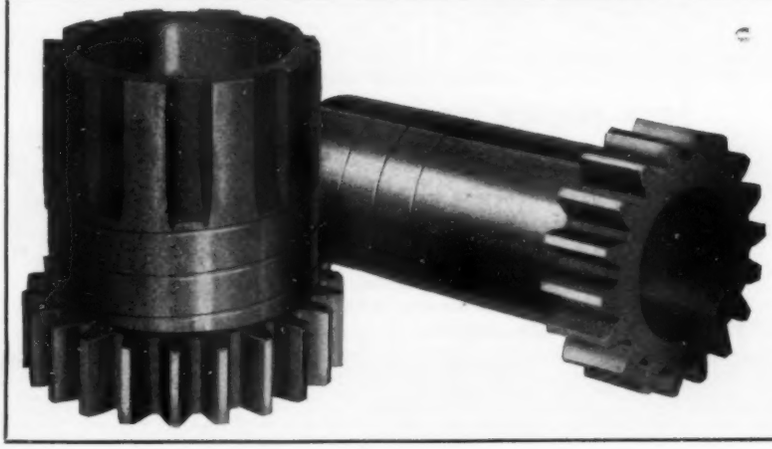

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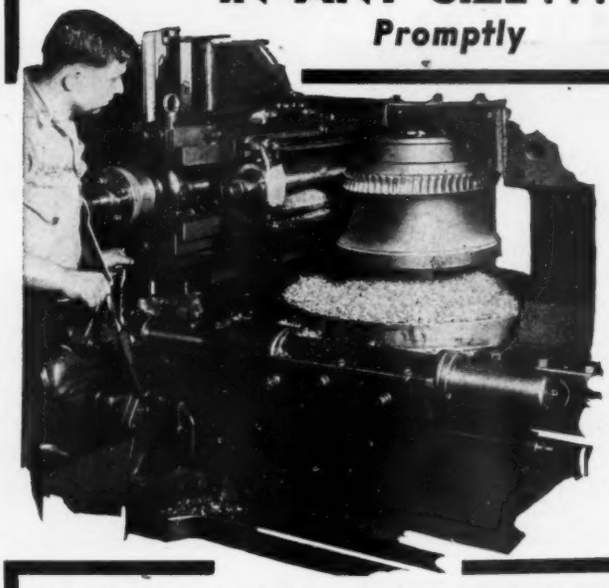

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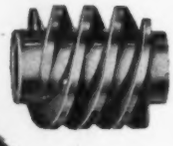

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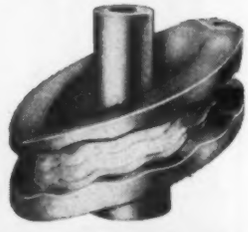

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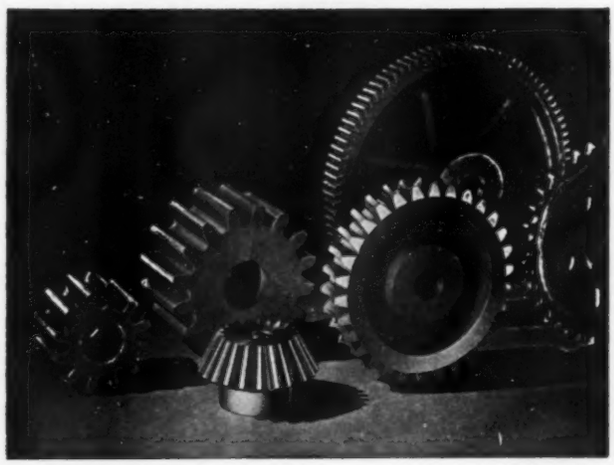

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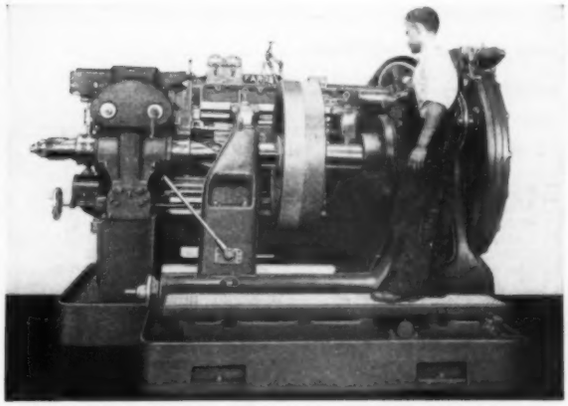

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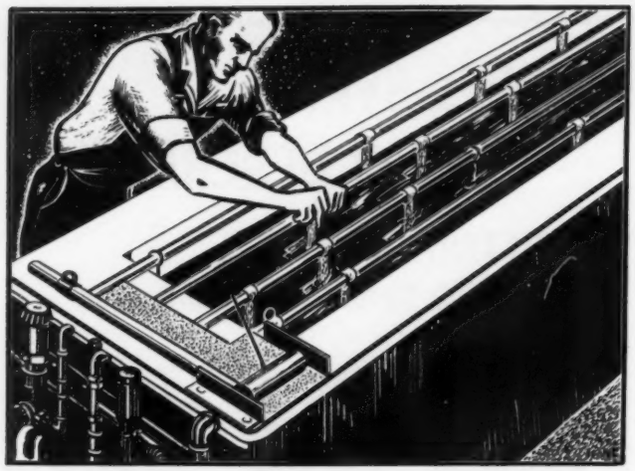

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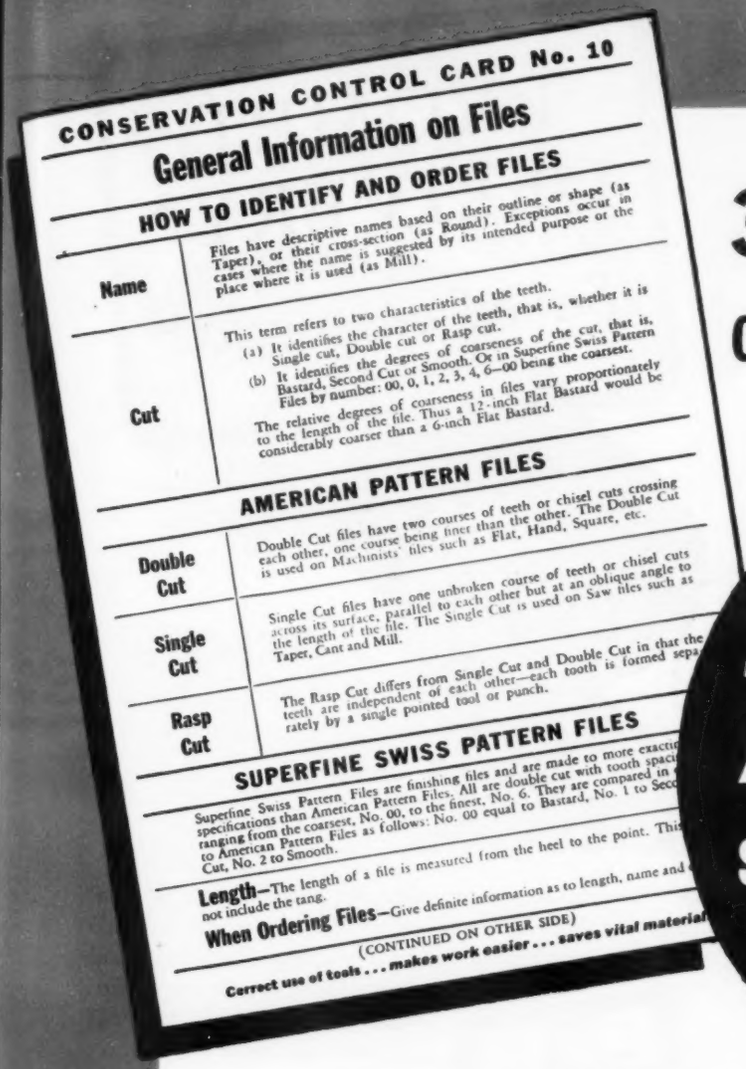

CONSERVATION CONTROL CARD No. 10

General Information on Files

HOW TO IDENTIFY AND ORDER FILES

Name — Files have descriptive names based on their outline or shape (as Taper), or their cross-section (as Round). Exceptions occur in cases where the name is suggested by its intended purpose or the place where it is used (as Mill).

Cut — This term refers to two characteristics of the teeth.
(a) It identifies the character of the teeth, that is, whether it is Single cut, Double cut or Rasp cut.
(b) It identifies the degrees of coarseness of the cut, that is, Bastard, Second Cut or Smooth. Or in Superfine Swiss Pattern Files by number: 00, 0, 1, 2, 3, 4, 6—00 being the coarsest.
The relative degrees of coarseness in files vary proportionately to the length of the file. Thus a 12-inch Flat Bastard would be considerably coarser than a 6-inch Flat Bastard.

AMERICAN PATTERN FILES

Double Cut — Double Cut files have two courses of teeth or chisel cuts crossing each other, one course being finer than the other. The Double Cut is used on Machinists' files such as Flat, Hand, Square, etc.

Single Cut — Single Cut files have one unbroken course of teeth or chisel cuts across its surface, parallel to each other but at an oblique angle to the length of the file. The Single Cut is used on Saw files such as Taper, Cant and Mill.

Rasp Cut — The Rasp Cut differs from Single Cut and Double Cut in that the teeth are independent of each other—each tooth is formed sepa rately by a single pointed tool or punch.

SUPERFINE SWISS PATTERN FILES

Superfine Swiss Pattern Files are finishing files and are made to more exacti specifications than American Pattern Files. All are double cut with tooth spaci ranging from the coarsest, No. 00, to the finest, No. 6. They are compared in to American Pattern Files as follows: No. 00 equal to Bastard, No. 1 to Seco Cut, No. 2 to Smooth.

Length—The length of a file is measured from the heel to the point. This not include the tang.

When Ordering Files—Give definite information as to length, name and

(CONTINUED ON OTHER SIDE)

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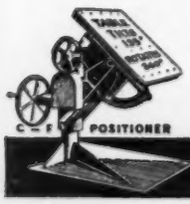

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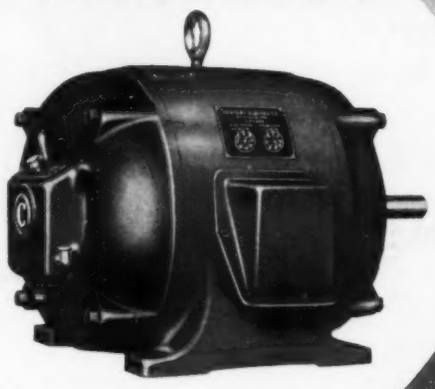

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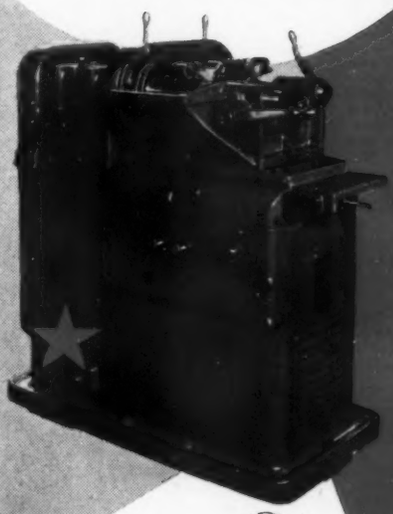

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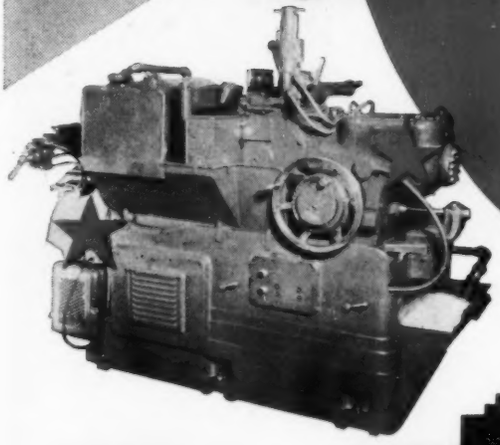

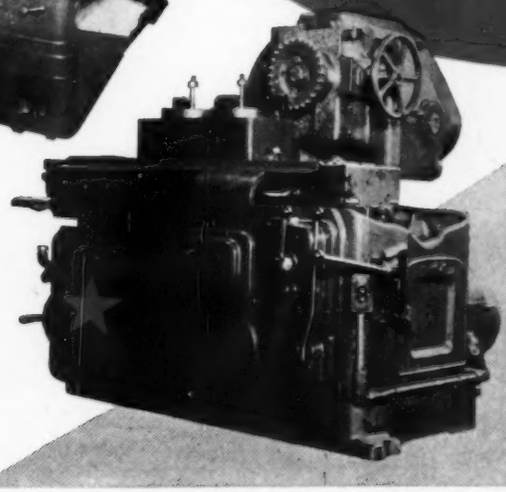

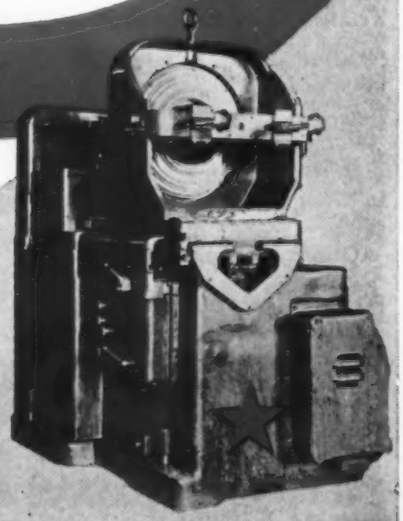

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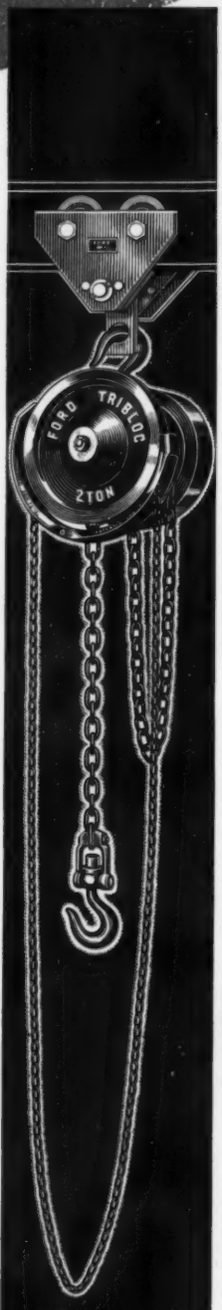

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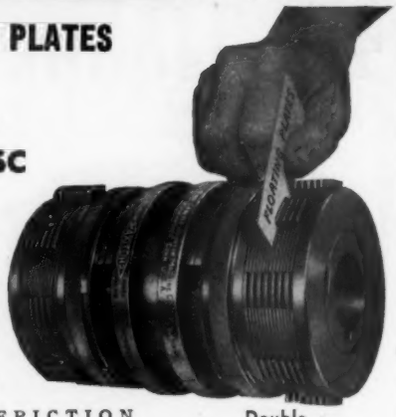

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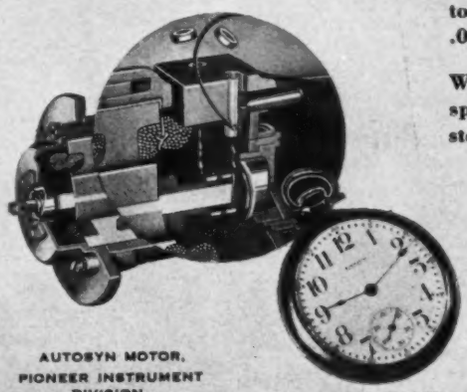
We specialize in such small parts and our long experience in supplying the optical and jewelry trades with sheet, wire and tubing and pen and pencil manufacturers with caps, tapers and shells, fit us admirably, in these times of emergency, to undertake the production of similar articles. Our equipment is available to roll sheet and draw tubing in any non-ferrous metals. We do not mean the standard sizes of the brass mills, but wherever close tolerances and speed of delivery are required. We can hold sheet and wire, in most metals, to plus or minus .0001 and tubing to plus or minus .00015 in small gauges.



AUTOSYN MOTOR, PIONEER INSTRUMENT DIVISION, BENDIX AVIATION CORP.

WATCH SHOWS RELATIVE SIZE

We carry small stocks which can be finished to close specifications on Priority or we will refinish your own stock to specifications, trim tubing or cup and form any non-ferrous metal in quantity.

Let us show you how we can help speed your production by doing some of this work for you.

D. E. MAKEPEACE COMPANY
ATTLEBORO, MASS.

It's New—THE Filtaire PORTABLE DUST COLLECTOR

The NEW FILTAIRE PORTABLE DUST COLLECTOR eliminates the danger, expense, and nuisance of dust laden air. The Filtaire is ideal for use with grinding and polishing machines where no central dust collecting system is available. It is completely self-contained, yet fits any machine without the use of special hoses, hoods, tanks, or piping. Plug it in at the nearest 110-volt outlet and it's ready to go.

A spun glass Dustop filter stops all wheel and work dust at the front of the Filtaire. This inexpensive filter is *fireproof* and easily *replaceable*.

Filtaires will pay for themselves quickly in your shop—

MAIL THE COUPON TODAY FOR DETAILS!

Please send me my free copy of the new Filtaire Folder.

NAME..... TITLE.....

COMPANY.....

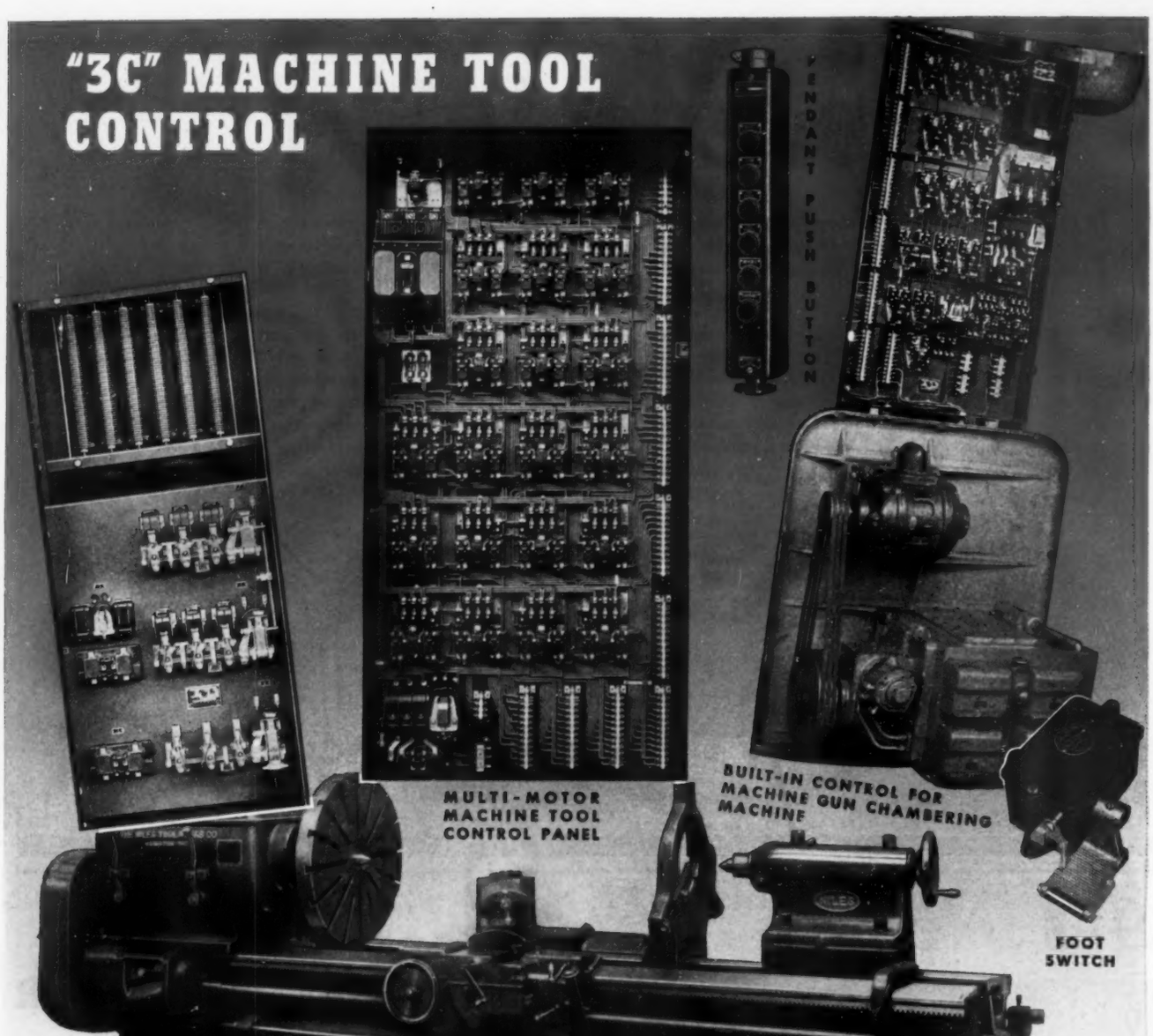
STREET.....

CITY..... STATE.....

A. M.

EDWARD BLAKE COMPANY 634 COMMONWEALTH AVE. NEWTON CENTRE, MASS.

"3C" MACHINE TOOL CONTROL


PENDANT PUSH BUTTON
MULTI-MOTOR MACHINE TOOL CONTROL PANEL
BUILT-IN CONTROL FOR MACHINE GUN CHAMBERING MACHINE
FOOT SWITCH
HEAVY DUTY LATHE AND CONTROL PANEL

"3C" Machine Tool Control carries on the reputation for stability Clark Controller Co. devices have earned in other heavy duty industries. • Switches, Push Button Stations, Contactors, Relays, Starters—as separate units, or engineered into compact panels to fit into machine recesses or into floor or wall mounted cabinets—all are built to deliver trouble-free service with minimum maintenance. • And minimum maintenance is a feature of "3C" design. Practically all "3C" Machine Tool Control can be dis-assembled and re-assembled with only a screw driver —and there's always plenty of wiring space.

Our nearest District Office or Agency is at your service in Machine Tool Electrical Control Problems.

OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

In times like these, it's very important to *Select the RIGHT MOTOR* for every application—

WAGNER motors may be broadly divided into three general classes: polyphase, single-phase, and direct-current. The following outline shows the various subdivisions and the Wagner type letters which apply to them.

1. Polyphase
- *A. Squirrel-Cage Rotor*
  1. Low resistance Type RP-1
  2. High reactance Type RP-5
  3. High resistance Type RP-6, RP-7
- *B. Wound Rotor*
  1. Low resistance Type RS
  2. High resistance Type RT
  3. Synchronous Type RN

2. Single-Phase
- *A. Wound Rotor*
  1. Repulsion start Type RA
  2. Repulsion-induction Type RG
- *B. Squirrel-Cage Rotor*
  1. Capacitor-start Type RK
  2. Split-Phase-start Type RB

3. Direct-Current
- *A. Wound Rotor*
  1. Compound-Wound Type RD

Polyphase Squirrel-Cage Low-Resistance (1/6 to 400-hp)

Because of its simplicity, rugged construction, and low cost the RP-1 motor is the most popular type used in industrial plants. It has sufficient starting-torque for operating machine tools, fans and blowers, centrifugal pumps, some types of compressors, and many other kinds of machinery.

Polyphase Squirrel-Cage High-Reactance (1-1/2 to 125-hp)

Some applications require motors of higher starting-torque than obtainable in RP-1 motors. Typical examples are crushers, plunger pumps, belt conveyors starting under load, large air compressors, large refrigerating machinery, mixers, etc. For such applications Wagner builds a high starting-torque motor with high-reactance rotor, known as type RP-5.

Polyphase Squirrel-Cage High-Resistance (1/2 to 150-hp)

The motors discussed thus far are not suitable for operating machines having heavy flywheels because these motors will not permit the flywheels to deliver enough of their stored energy during the punching or drawing operation. For these applications Wagner builds RP-6 motors with high-resistance rotors. During the working part of the cycle, the motor speed drops considerably and allows the flywheel to do its work. High-resistance rotors are also used in RP-7 (1 to 50-hp) elevator motors, which are used on low-speed elevators, hoists, dumb waiters, etc.

Polyphase Wound-Rotor Low-Resistance (1 to 250-hp)

There are two reasons for the existence and application of motors of the Wagner type RS. First, since the rotor winding is connected to slip-rings making it easy to connect a high external resistance in the rotor circuit, it is possible to obtain extremely low starting-currents without impairing the running performance. Second, by introducing resistance in the rotor circuit of an RS motor it is possible to obtain speeds from 50 to 97% of synchronous speed. This method of speed control is satisfactory when the load is constant. For obtaining different speeds on applications where the load varies, Wagner recommends the use of polyphase squirrel-cage multi-speed motors, type MRP, which may be obtained with two, three, or four speeds.

Polyphase Wound-Rotor High-Resistance (40 to 100-hp)

The air-conditioning industry sometimes requires motors which must have higher starting-torques and lower starting-currents than can be obtained in good squirrel-cage motors. For such applications the Wagner RT motor was developed. The characteristics of unusually high starting-torque and exceptionally low starting-current are accomplished by using a high-resistance secondary winding which is permanently short-circuited.

Polyphase Wound-Rotor Synchronous (7-1/2 to 200-hp)

Wagner Synchronous "Fynn-Weichsel" motors, type RN, differ from conventional synchronous motors in that they have starting characteristics like RS motors, do not have separate exciters, and have simple starting devices. The RN motor is the ideal motor to install where power factor needs correction because it not only improves the power factor but also handles the toughest job to be found.

Single-Phase Wound-Rotor Repulsion-Start (1/8 to 15-hp)

For single-phase circuits there is no better motor than the Wagner RA repulsion-start induction motor, which starts as a repulsion motor with high starting-torque and low starting-current, and, upon approaching operating speed, is automatically converted into an induction motor. With few exceptions, if single-phase current is involved, the RA motor is the logical choice.

Single-Phase Wound-Rotor Repulsion-Induction (1 to 5-hp)

Filling-station compressors are often operated in cold locations under weather conditions which congeal the oil in the compressor crankcase and may increase the load until it is double its normal value. For such applications Wagner produced the RG motor which is a brush-riding machine with a squirrel-cage to limit the idle speed. This type of motor will carry any load which it can start and is ideal for filling-station compressor applications.

Single-Phase Squirrel-Cage-Rotor Capacitor-Start (1/6 to 1-hp)

In order to meet a competitive situation Wagner builds the RK motor, which is a capacitor-start induction machine.

Single-Phase Squirrel-Cage-Rotor Split-Phase-Start (1/20 to 1/3-hp)

The cheapest type of single-phase motor is the RB split-phase machine. It is recommended for applications where the starting duty is light and the period of acceleration is short. The RB-5 (1/6, 1/4 and 1/3-hp) is a special service motor intended for washing machines, mangles, etc., which operate only for a short period of time at infrequent intervals. The RB-5 motor should not be used on jobs which operate continuously.

Direct-Current Wound-Rotor Compound-Wound (1/6 to 3-hp)

Wagner also builds direct-current type RD motors, which are still required in some locations.

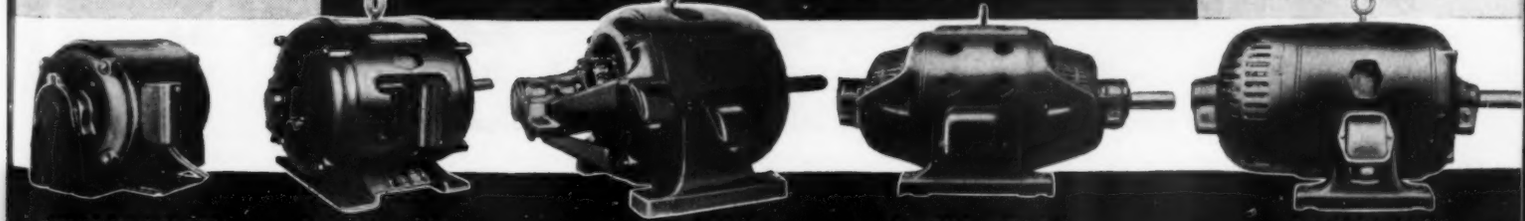
M-42-9

WAGNER ELECTRIC CORPORATION
6400 PLYMOUTH AVE. • • ST. LOUIS, MO., U. S. A.

BRANCHES IN TWENTY-FIVE PRINCIPAL CITIES

WAGNER
• MOTORS •

SEND FOR FREE BULLETINS DESCRIBING WAGNER MOTORS



Type RA Repulsion-Start-Induction Single-Phase Motor | Type RP Squirrel-Cage Polyphase Motor | Type RS Wound-Rotor Slip-Ring Motor | Type RN Fynn-Weichsel Synchronous Motor | Type RT Polyphase Induction Motor

MOTORS • TRANSFORMERS • FANS • BRAKES

SOME USERS OF

TURNER UNI-DRIVE

•

American Brake Shoe & F. Co.
Kellogg Division
Southern Wheel Division
Augusta Arsenal
Bendix Aviation Corp.
Burgess Battery Corp.
Cessna Aircraft Corp.
Chicago, Rock Island & Pacific R. R. Co.
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Perth Amboy Dry Dock Co.
Proctor & Gamble Co.
Republic Steel Corporation
Revere Copper and Brass, Inc.
SKF Industries
Sullivan Dry Dock Co.
Thos. A. Edison Co.
The Timken-Detroit Axle Co.
Toledo Scale Co.
The Todd Company
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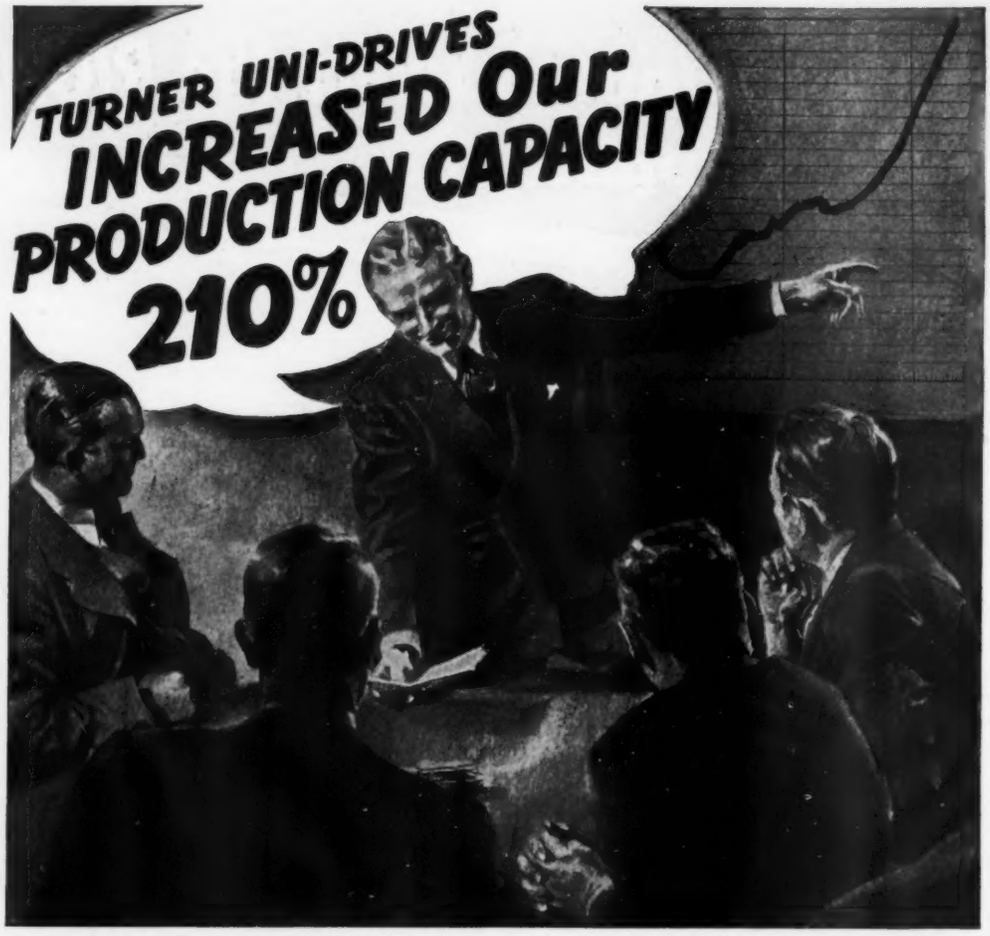


Over 6000 Units Installed In 1941

FROM COAST TO COAST TURNER UNI-DRIVE HAS PROVED TO BE THE SUCCESSFUL ONE-MOTOR DRIVE

•

Today, more than ever before, time is money. Production and *more* production is the demand. TURNER UNI-DRIVE is the answer. In hundreds of shops and plants this motorizing unit with selective sliding gear transmission is speeding production up 50% to 300%. It will do a good job for you!

Consider these features of UNI-DRIVE: Easily and quickly installed... 2 to 4 hours. No belts to shift. Big saving in power. More spindle speeds. Increased efficiency of machine and operator. Eliminates overhead countershafts. Drives on large cone at all speeds. Guaranteed for one full year. Furnished in various sizes to meet practically every need.

Your first installation will prove to you a score of other time-and-money-saving advantages of TURNER UNI-DRIVE.

Don't put it off longer...see your dealer today or write for full information and prices.

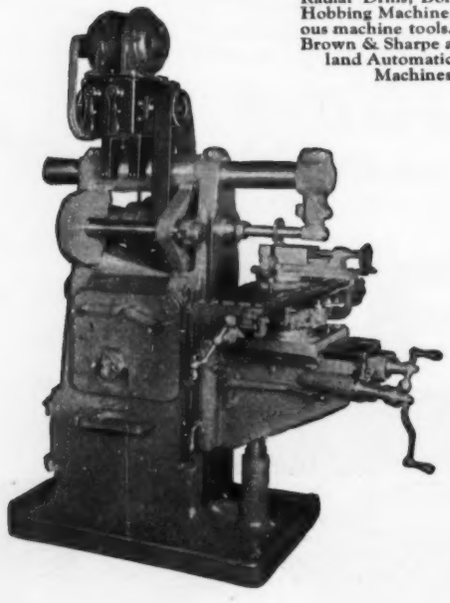
THE TURNER UNI-DRIVE COMPANY

(Sales Division: Turner Machinery Co.)

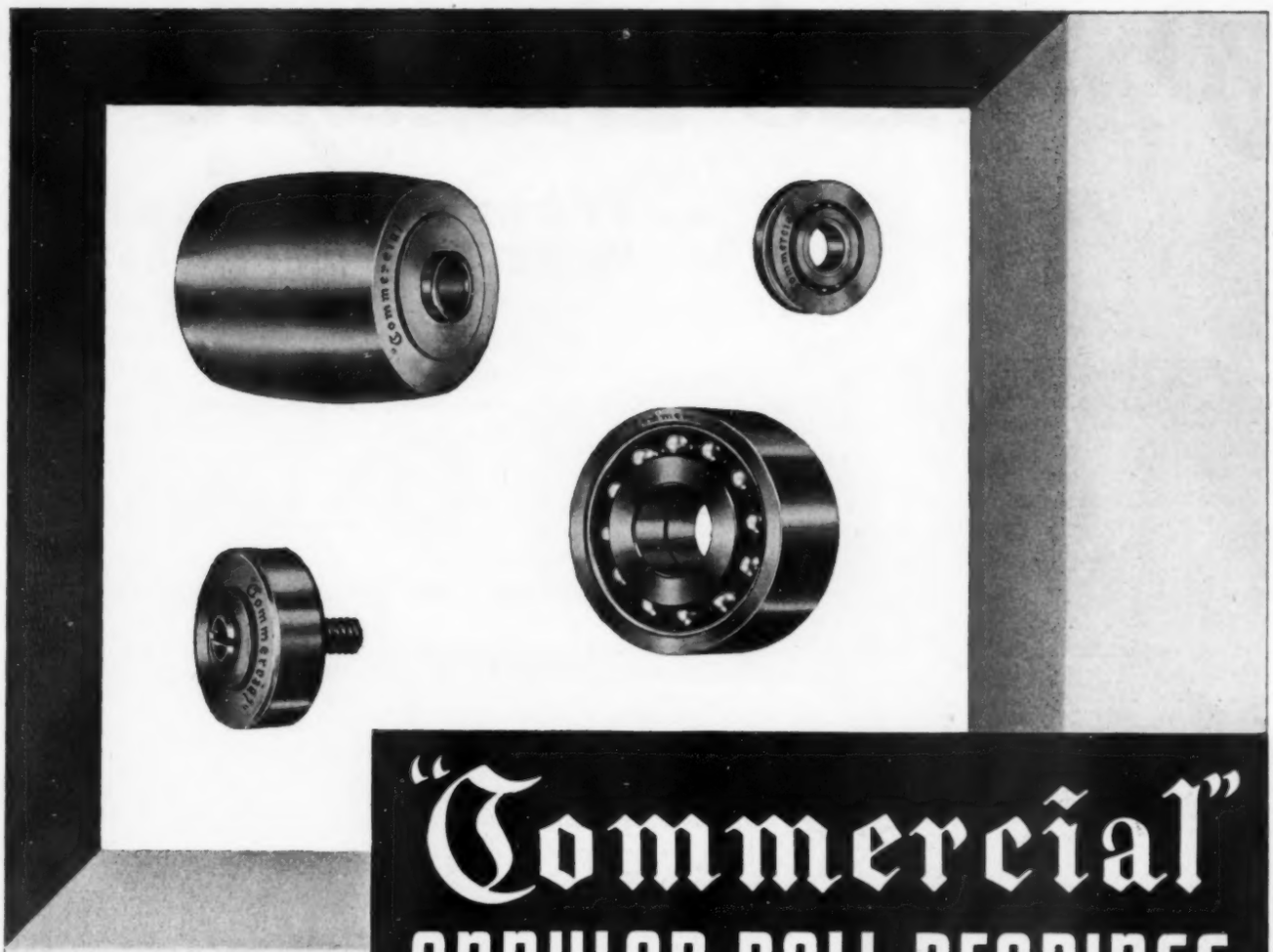
3416 Terrace St. . Kansas City, Mo.

IT DOES THE JOB

on Lathes, Shapers, Milling Machines, Turret Lathes, Radial Drills, Boring Mills, Hobbing Machines and various machine tools. Also for Brown & Sharpe and Cleveland Automatic Screw Machines.



TURNER
UNI-DRIVE
Motorizes Machine Tools



"Commercial" ANNULAR BALL BEARINGS

BALL BEARINGS FOR EVERY PURPOSE

"Commercial" Annular Ball Bearings are available in nearly all standard types and sizes. We also manufacture SPECIAL types of bearings designed for particular purposes—to meet your own needs and specifications. On this page we illustrate special **"Commercial"** bearings used in various products. For instance:

BALL BEARING ROLLERS FOR TYPEWRITERS	BALL BEARING ROLLERS FOR OVERHEAD TROLLEY CONVEYORS
BEARINGS FOR STRAIGHT EDGE CABLES	TAPE ROLLER OF PULLEY FOR PAPER FOLDING MACHINES

This gives some idea of the wide variety of bearings manufactured by us. All **"Commercial"** Bearings are precision-built, accurate, tough and provide efficient, satisfactory service under *all* conditions.

Whether you need a few, or a great many units, our Engineering Staff will be pleased to assist in solving your ball bearing problems. Send for complete information and latest catalog.

THE SCHATZ MANUFACTURING CO.

POUGHKEEPSIE, N. Y.

Detroit Office: 2640 Book Tower • Chicago Office: 902 S. Wabash Ave.

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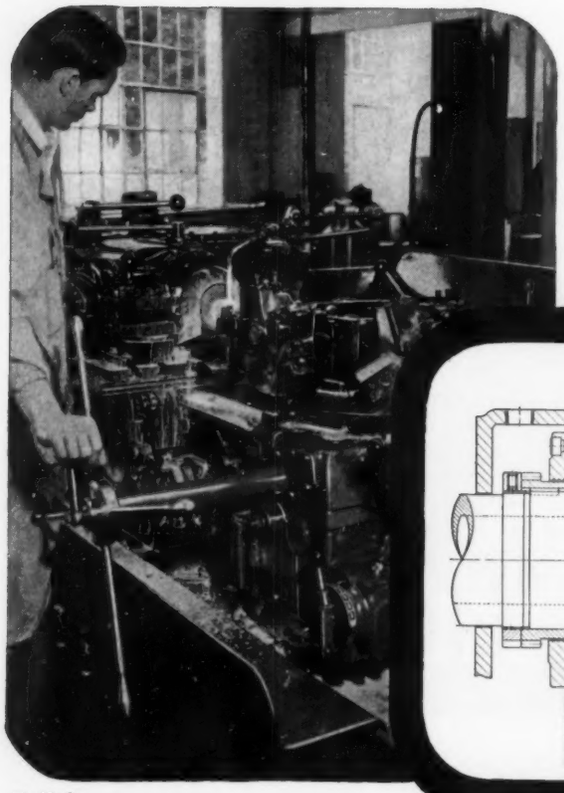
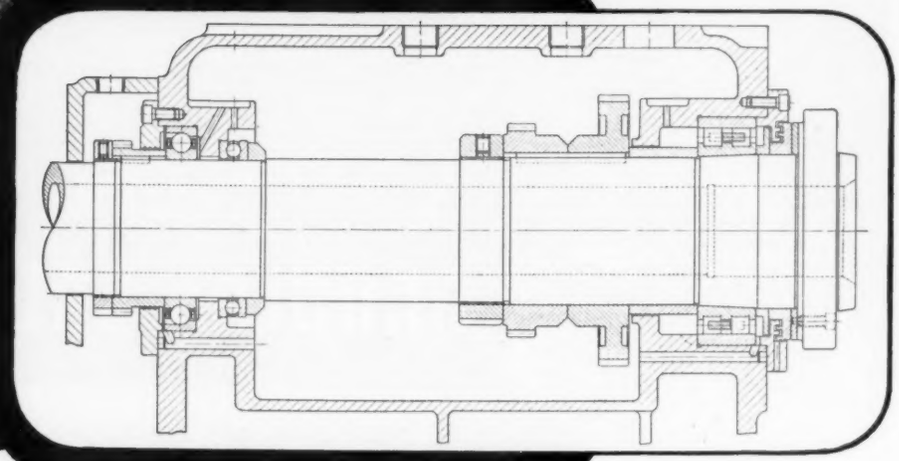
Proved Design

••AFTER FIVE YEARS OF PREFERENCE ON J & L LATHES

In February, 1937, Jones & Lamson engineers selected the first SKF Double Row Cylindrical Roller Bearing to be used on a turret lathe spindle. Quick to recognize the many outstanding characteristics of this bearing, they sent through a repeat order . . . and another . . . and another, rapidly increasing their use of these bearings on the work end of turret lathe spindle mountings for more than five years. The result has been a complete success, so no wonder they use them so extensively! 5042

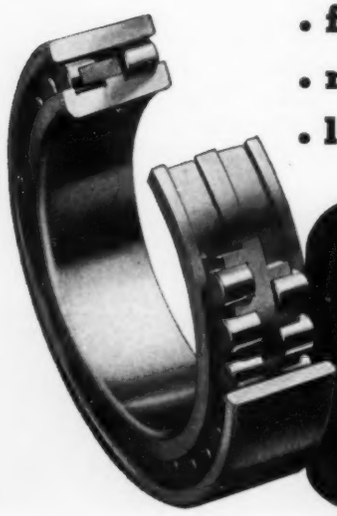
SKF INDUSTRIES, INC., PHILADELPHIA, PENNA.



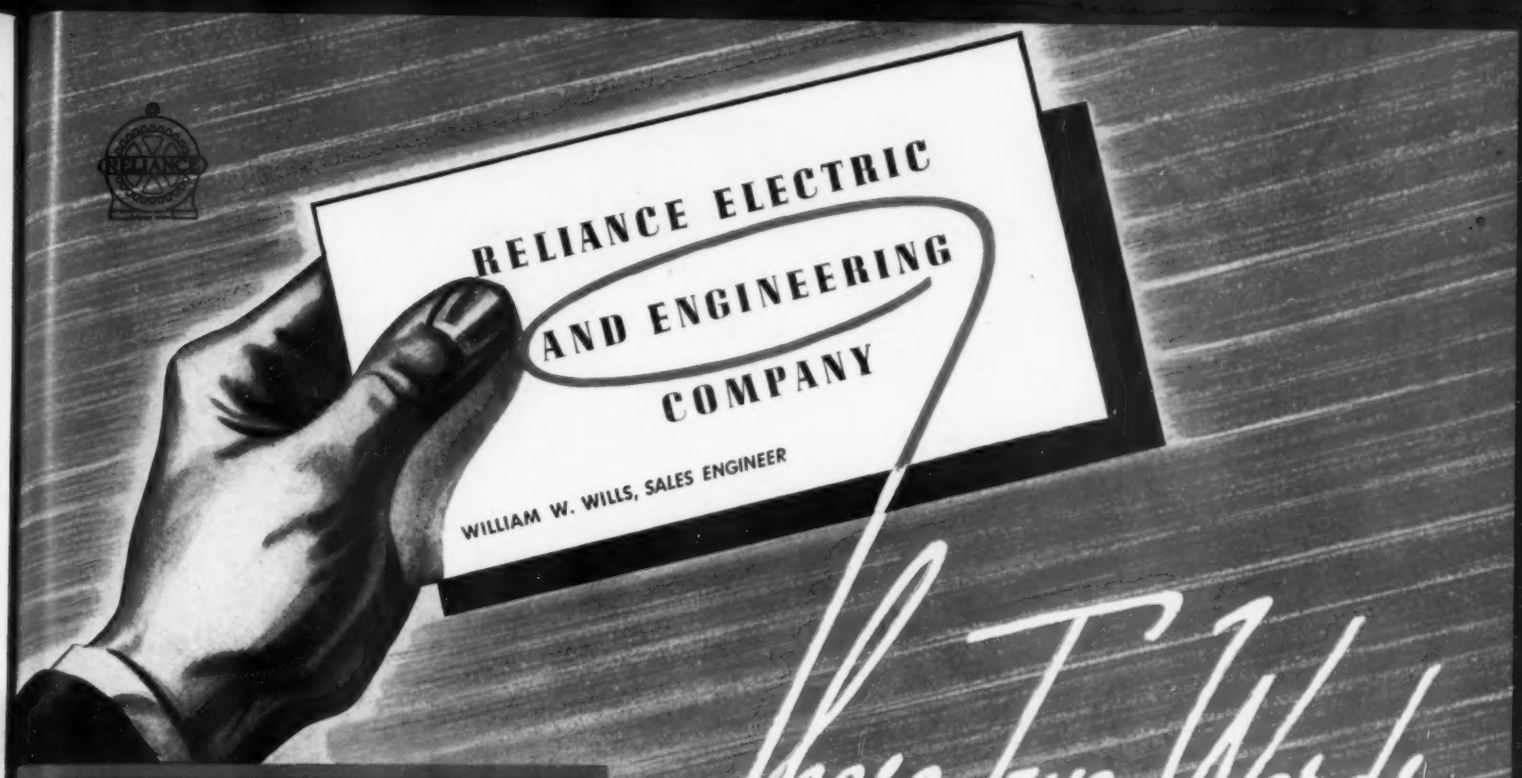


Built by
JONES & LAMSON MACHINE CO.

- **continuous peak production from heavy cuts and high speeds**
- **freedom from chatter**
- **maintained accuracy**
- **long life**



SKF
BALL AND ROLLER
BEARINGS



These Two Words

Motor-drive provides within itself a means of:

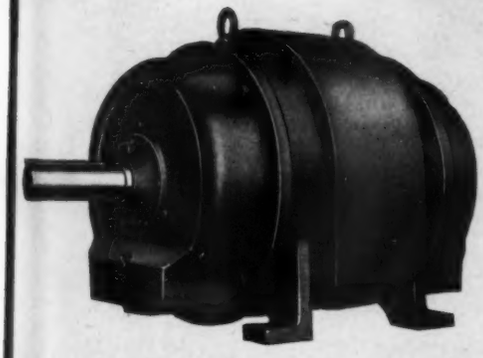
Speed Control	Reversing
Braking	Remote Control
Tandem Operation	Controlled Acceleration
Tension Control	Safety

Slow Speeds for inching, threading, inspection

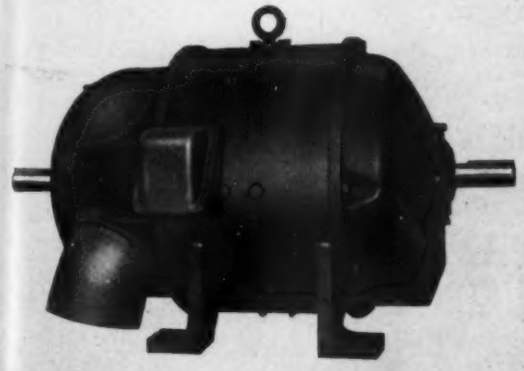
Applying them to boost production and improve quality is APPLICATION ENGINEERING. That's our business.

MAKE *MOTOR-DRIVE* *MORE THAN* POWER!

The man who sends this Reliance card to you is skilled in Application Engineering. He is prepared to discuss motor-drive as a means for boosting production and improving the quality of the products made in your plant. He represents an organization whose "bread and butter" for 35 years has come from showing industry how electric motors can be used profitably to do *many things* besides turn shafts and gears. To get the most from these production aids call in a Reliance man when your plans are in the early stages. He can help make motor-drive an integral part of your production equipment and not an appendage. No obligation, of course.



Splash-proof Type AA Squirrel-cage A-c. Induction Motor with ball bearings.



Splash-proof Type T D-c. Reliance Motor with ball bearings.

RELIANCE ELECTRIC & ENGINEERING CO.
1088 Ivanhoe Road • • • Cleveland, Ohio

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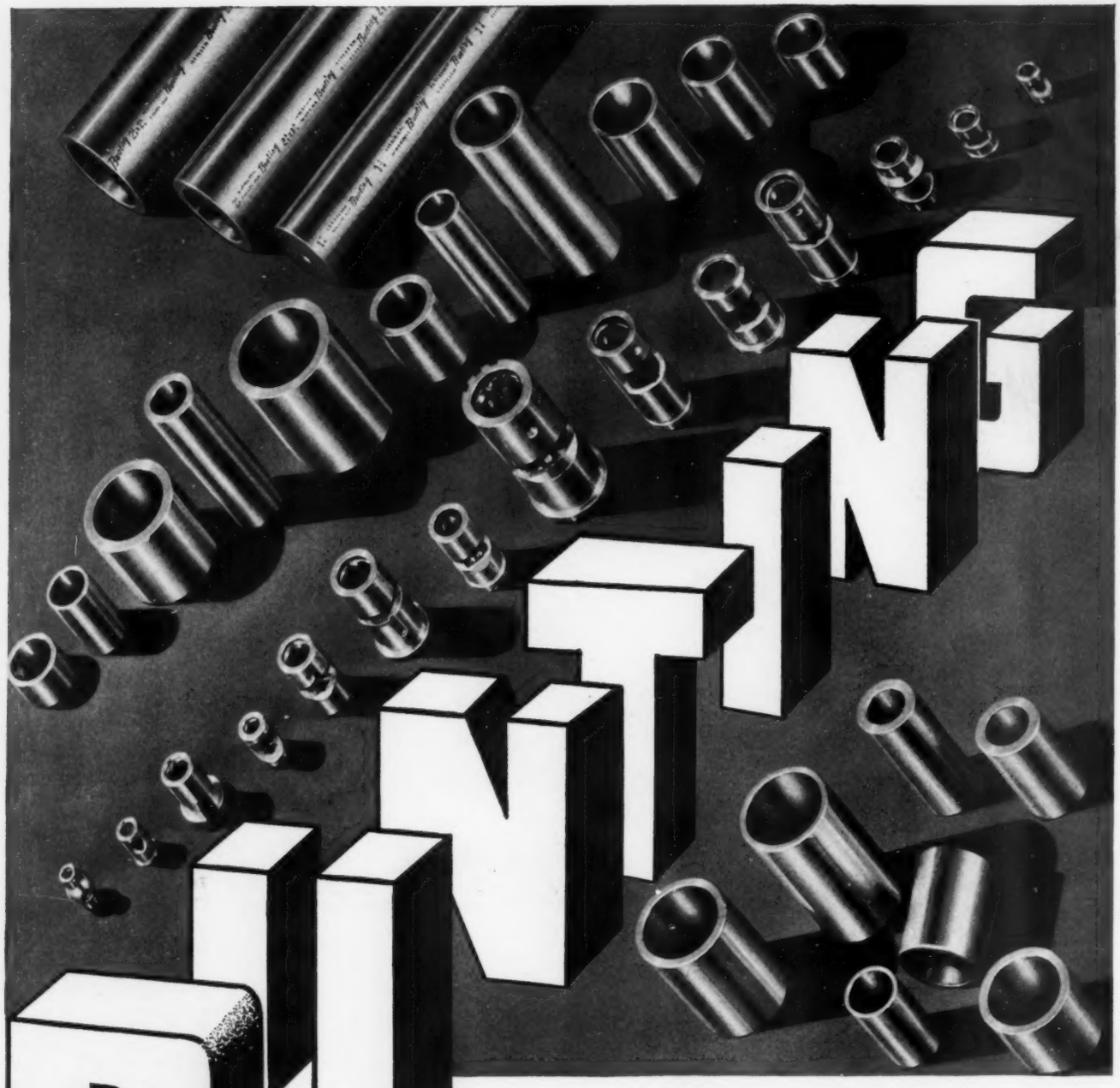
PORTLAND, ORE. • ST. LOUIS • SAN FRANCISCO • SYRACUSE, N. Y. • and other Principal Cities

RELIANCE A-C D-C MOTORS



BRONZE BUSHINGS
•
BEARINGS
•
PRECISION BRONZE BARS
•
BABBITT METALS

This Bunting Catalog contains much bearing data of value and interest to you.

☆ Quick, economical production and maintenance of machines and equipment in war industries is provided by complete machining and finishing of Bronze Bearings and Bars at the Bunting factory. Bunting Standardized Bearings in many sizes are ready for assembly in machine tools, industrial machinery of all kinds and electric motors. Bunting Precision Bearing Bronze Bars save about 25% of purchased metal and 50% of time in set-up and machining operations when compared with rough bars. Ask your wholesaler.

THE BUNTING BRASS & BRONZE COMPANY, TOLEDO, OHIO

WAREHOUSES IN ALL PRINCIPAL CITIES

Here's *Exactly* Why

The CONCAVE SIDE

Saves Belts-Saves Rubber-Saves Power!

Pick up any V-belt that has straight sides. Bend that V-belt while you grip its side-walls as in the picture above. You will feel the sides of the belt bulge out —as shown in Figure 1 on the right. Clearly, that out-bulge gives the belt a shape that does not fit its sheave groove.

Now look at Figure 2. There you see what happens when you bend a belt that is built with the patented Concave sides. You get a similar change in side-wall shape—but what a different result! The precisely engineered Concave side becomes perfectly straight. There is no out-bulge:—the full side-width of the belt *uniformly* grips the sheave groove wall. This means *uniform* wear—*longer* life—a saving in belts for you, a saving in rubber for the Nation. In addition, this full side-width grip on the pulley carries heavier loads without slippage—another saving of belts and a saving in power too!

Only belts built by Gates are built with the Concave side, a Gates patent.

What Happens When a V-Belt Bends

FIG. 1

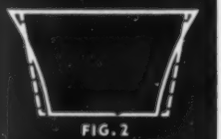


FIG. 2

THE GATES RUBBER COMPANY

Engineering Offices and Stocks in All Large Industrial Centers

GATES VULCO ROPE DRIVES

Chicago, Ill.
549 West Washington

New York City
215-219 Fourth Avenue

Birmingham, Ala.
405 Liberty National Life Bldg.

Los Angeles, Cal.
2240 East Washington Blvd.

Denver, Colo.
999 South Broadway

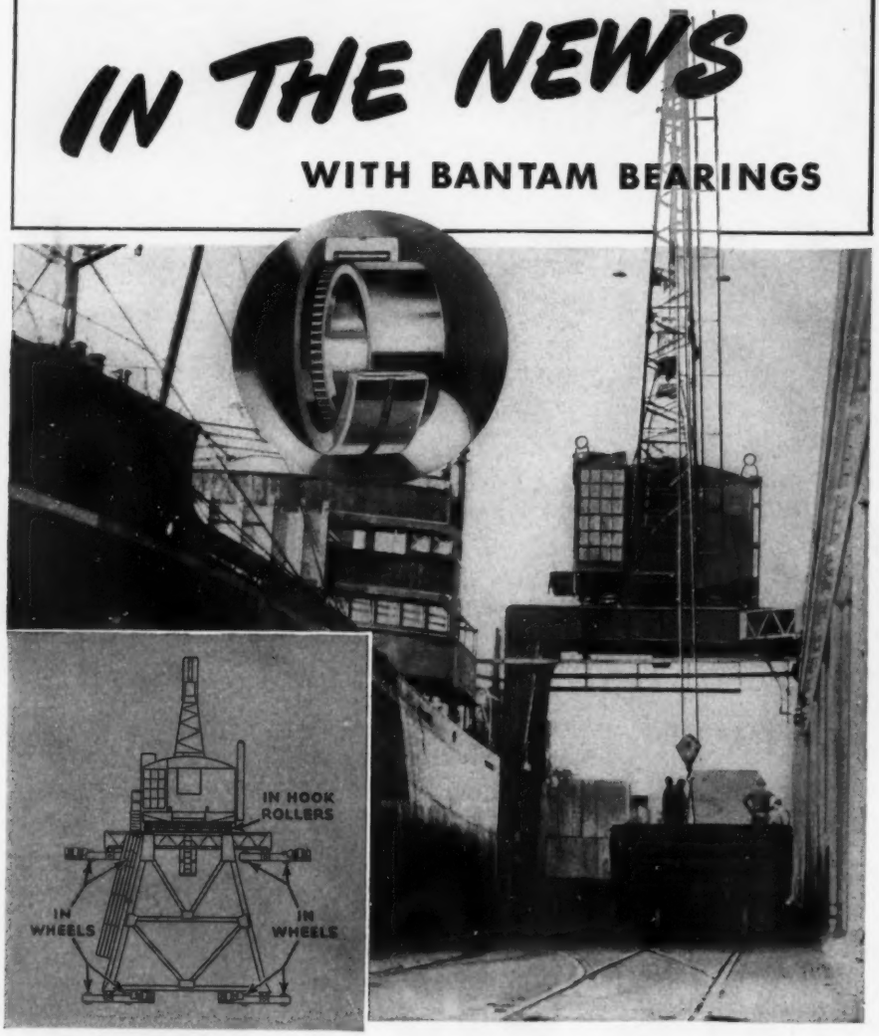
Dallas, Tex.
2213 Griffin Street

Portland, Ore.
333 N. W. 5th Avenue

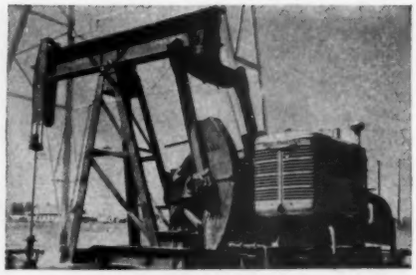
San Francisco, Cal.
2700 16th Street

IN THE NEWS

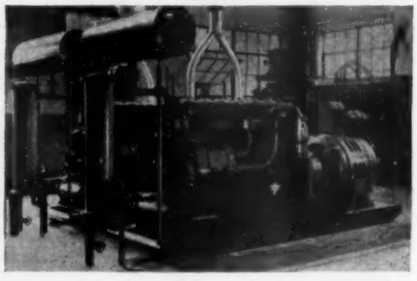
WITH BANTAM BEARINGS



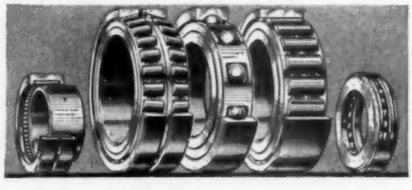
SPEEDY SHIPMENT OF WAR MATERIALS is a factor of vital importance in the program of the United Nations. Supplies are quickly loaded on shipboard by this revolving gantry crane built by American Hoist & Derrick Company. Crane is equipped with three hoisting drums, one lifting 15,500 pounds at 300 feet per minute, the others with a capacity of 10,000 pounds at 270 feet per minute. 20 Bantam Quill Bearings are used on travel mechanism, as shown in drawing, and on the wire rope blocks—another instance of the ways in which Bantam Bearings are rendering efficient, reliable performance in serving every phase of the Victory program.



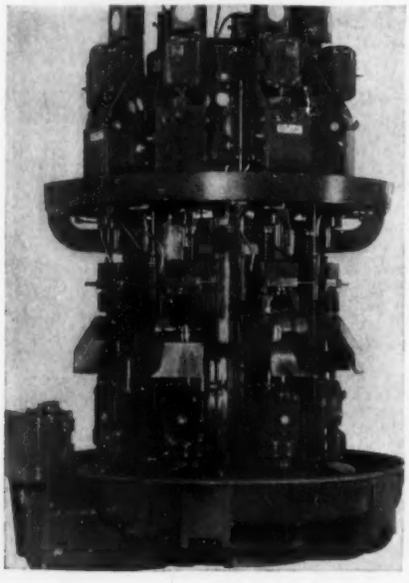
IN OIL WELL PUMPING UNITS, Bantam Quill Bearings are used by leading manufacturers to assure quiet, efficient operation, long service life, minimum need of attention. Cabot Shops, Inc., installs these compact, high-capacity units on equalizer and center bearings of its larger pumpers, obtains the advantages of anti-friction construction throughout.



ECONOMICAL POWER GENERATION is assured by modern engine and generator design. Developing 115 KW each in continuous 24-hour operation, these two generating units are powered by Murphy Diesel Company's 215 HP engines, with Bantam Quill Bearings in the generator drive assembly. For further information on these low-cost, high-capacity bearings, write for Bulletin D-104.



BANTAM'S ENGINEERING COOPERATION is especially valuable in meeting new and unusual requirements. Bantam makes every major type of anti-friction bearing—straight roller, tapered roller, needle and ball. Bantam engineers aid in the selection of the type that best suits your application—or design special bearings that meet your requirements. If you have a difficult bearing problem, TURN TO BANTAM.



SPEED AND ACCURACY are essential in machine tool operation—and Bantam's broad experience in bearing design and manufacture contributes to both these qualities. In this eight-station continuous drilling machine built by The Foote-Burt Company, the entire column rotates on a Bantam Ball Thrust Bearing measuring 27" O.D. by 22" I.D. Here is a typical example of Bantam's skill in the design of large bearings for heavy-duty applications.

BANTAM BEARINGS

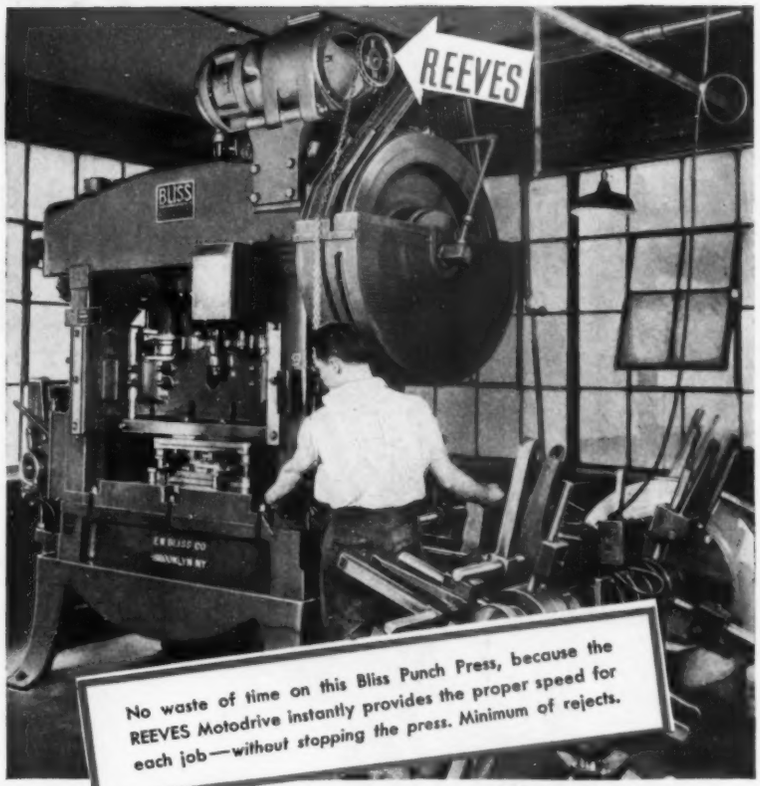
STRAIGHT ROLLER · TAPERED ROLLER · NEEDLE · BALL

BANTAM BEARINGS CORPORATION • SOUTH BEND • INDIANA

Yesterday

When Rigid Economy Was Paramount . . .

When competition was at its keenest and getting costs down and profits up was the order of the day in every plant, REEVES Variable Speed Control became firmly established in industrial production. Then, as now, REEVES Speed Control made it possible to improve both the quality and quantity of output and to save costly man-hours of labor by enabling the operator to run his machine at *exactly the right speeds* for best results on every job.

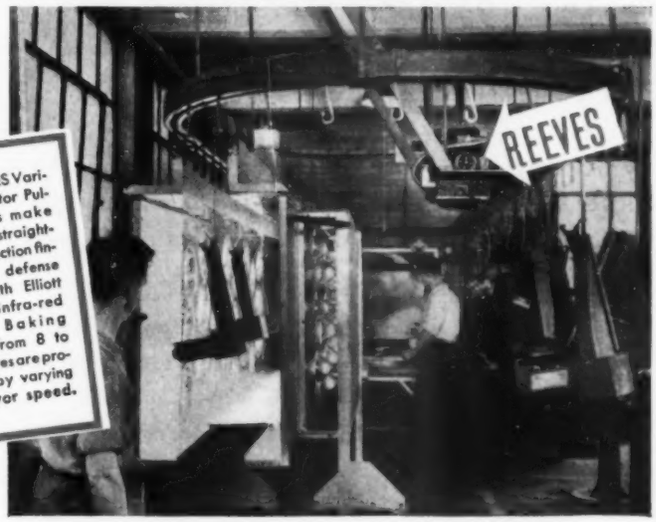


No waste of time on this Bliss Punch Press, because the REEVES Motodrive instantly provides the proper speed for each job—*without* stopping the press. Minimum of rejects.

Today

When Production Must Hit a New Peak . . .

Today there is no time to waste with inefficient methods, with machines operating too fast or too slow for best results. Every man-hour of labor must be made to count. Every yard, pound or gallon of precious materials must be conserved. Production must hit a new peak, but with no sacrifice of quality. REEVES Drives, which provide complete speed flexibility, are a basic factor in accomplishing these objectives.



Here REEVES Vari-Speed Motor Pulley helps make possible straight-line production finishing of defense parts with Elliott Electric infra-red oven. Baking cycles from 8 to 18 minutes are provided by varying conveyor speed.

-and Tomorrow?

Tomorrow your machines may be called upon to handle entirely different materials, produced under entirely different conditions. *Applied now,* REEVES Speed Control will pay dividends in increased machine efficiency, *after the war* as well as in the present emergency. Let our engineering department help you.

REEVES PULLEY COMPANY • *Dept. A* • COLUMBUS, INDIANA

Send for copy of helpful new 20-page book "More Output for Defense," illustrating and describing 26 examples of how you can step up your production with accurate speed control.

Minimum Waste - Maximum Production

REEVES Speed Control

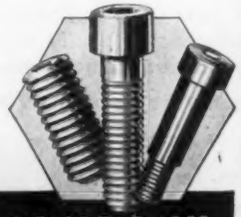
Conserve!

SAVE MATERIAL—save stock—save money as well by making machine parts *less bulky!* Pack more holding-power in smaller parts, narrower flanges, more compact assemblies! Use ALLEN Hollow Screws for further streamlining and reducing structural bulk!

The greater strength of Allen screws permits *smaller* screws to be used. . . Their internally-engaging hex keys require *less room* for wrench-movement in setting up. . . The keys themselves are the most economical form of wrench possible to make,—the most *saving* in metal.

Utilize these Allen features to help Uncle Sam hold on to his precious bundle of stock. He cannot have it wasted; he needs every ounce of metal to hurl at the enemy. Even a *little* saving on *each* machine adds up to the weapons that WIN.

Your local Allen Distributor will accommodate you to the utmost of his capacity and available supplies.



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SURFACE PLATES

from the giant size, 6 x 14 ft., to the small fellows, 10 x 15 in.

From the center to the very edge, every inch of the surface exemplifies precision—in every size of surface plate—from the 10 x 15 in. size to the gigantic size of 6 x 14 ft.

Designed for accurate and dependable inspections. These plates show no distortion, and resist deflection under reasonable load.

Distinctive form of ribbing supported by specially constructed standard, equipped with unique vibration-proof adjusters, assures you of surface plates that maintain a constant level.

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that have Increased Production

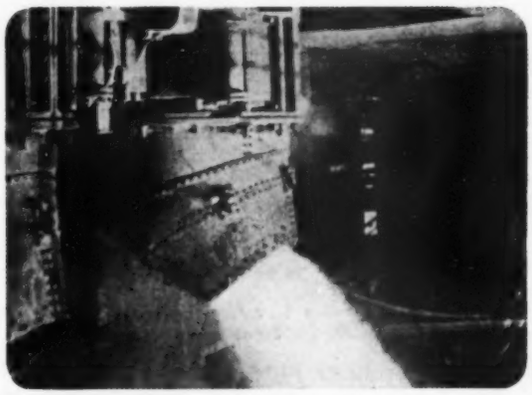
SIR HENRY BESSEMER

The Bessemer Converter ranks as one of the outstanding inventions of all time. It made possible mass production of good steel at a low price, greatly facilitating production.

THE Knurled heads of "Unbrako" likewise aid in stepping up production because—even greasy fingers—get a firm non-skid grip on the knurls of the "Unbrako". There is no slip or lost motion as with ordinary, smooth head screws. Often adjustments can be made with just a pair of pliers. Saves time that way, too. Even, newer, less experienced hands find the Knurled "Unbrako" an aid in keeping production up with the old timers.

No premium price—deliveries better than average. Send for literature, and accelerate production with "Unbrako".

***"Unbrako" Self-Locking Hollow Set Screws with the* KNURLED POINTS**



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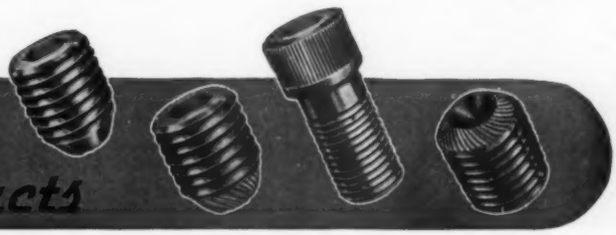
The KNURLING of Socket Screws originated with "UNBRAKO" years ago.

Reg. U.S. Pat. Office

UNBRAKO *Screw Products*



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Top surface is of ample thickness to permit drilling, tapping or other machining where it is desirable to mount tool details on the plate.

The accurate working surfaces of Lombard Bench Plates lend them particularly for use in bench assembly work of small precision pieces, as well as for a wide range of bench inspection and layout operation.

Note heavily ribbed construction, insuring an ever level working surface under mass production work.

Stock size 10 x 14 x 2, approx. wt. 31 lbs.
Inquiries solicited on any size bench plate.

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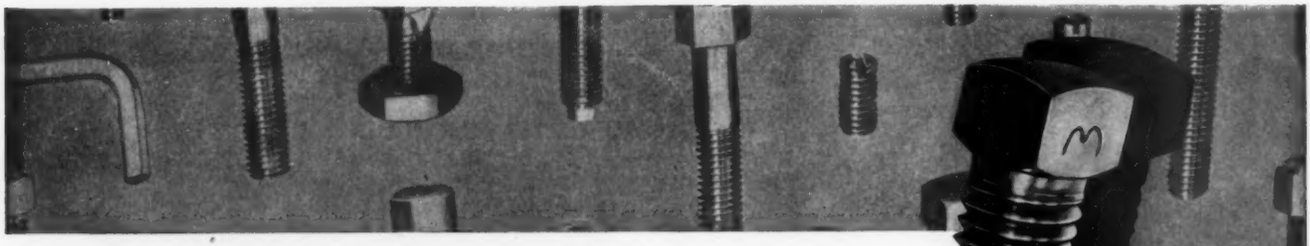
200 MAIN ST. ASHLAND, MASS. U. S. A.



MAC-IT Quality Alloy Steel Screws

The Mac-it square head set screw featured here is made for the toughest kind of holding down jobs—forming machine bearings, giant axle housings, locomotive applications and the like.

OTHER MAC-IT PRODUCTS INCLUDE:

Socket Head Cap Screws • Hollow Set Screws • Stripper Bolts
Hexagon Socket Pipe Plugs • Hexagon Head Cap Screws

Made of alloy steel, Mac-its are milled from the bar, with die-cut threads, and heat-treated for maximum strength.

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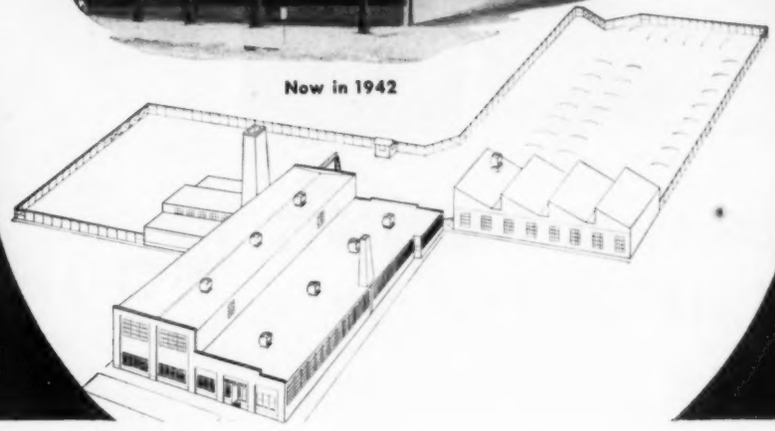

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During this time, our customers' (your) business has made it possible for us to serve certain needs of industry.

Maintaining this service has meant that in every few years, additional facilities have had to be incorporated and in more than a few instances, this has called for added floor space. That these additions have been necessary has shown to us that we have a right to be proud of the manner in which we have tried to cooperate.

Invested in our products, the experience that is primarily a result of this service cannot but be of assistance to users of this equipment. Again, the solution of new problems are generally that much closer because of this experience.

We here at T-J want, now more than ever, to continue, and to extend, this service. Offices and Factory at 615 North Mechanic Street, Jackson, Michigan.

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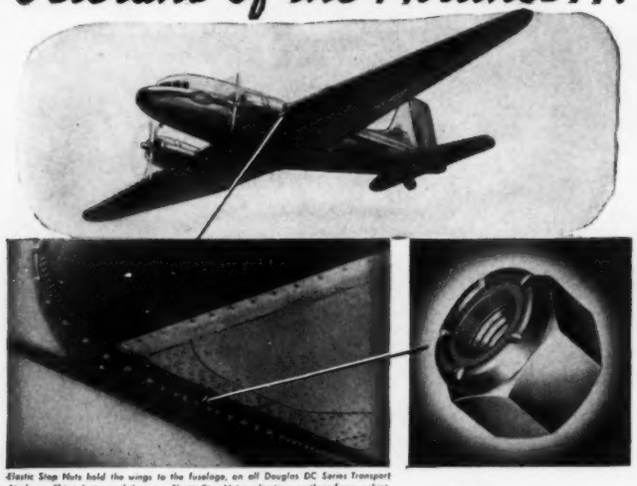

Elastic Stop Nuts hold the wings to the fuselage, on all Douglas DC Series Transport Airplanes. This is but one of the many Elastic Stop Nut applications on these famous ships.

DOUGLAS DC TRANSPORTS *and* ELASTIC STOP NUTS

Since 1936, more than 500 Douglas DC Series Transport Airplanes . . . in the air 2,400,000 hours . . . have flown over 350,000,000 miles. The meaning of this remarkable record, in terms of safe and rapid transportation, is well known.

One important reason for this performance, and for the fact that these ships are still in top flying condition, is that they are fastened throughout with vibration-proof Elastic Stop Nuts . . . more than 30,000 nuts on each ship.

These self-locking self-gripping nuts are used today, at vital structural and secondary connections, on every military and transport airplane built in the Western Hemisphere . . . and on innumerable other classes of mechanical and electrical equipment . . . including many of America's tools of war, from tanks and torpedo boats to gun mounts and radio sets.

TEST ELASTIC STOP NUTS on your products and equipment. Sample nuts will be furnished without cost or obligation.

Catalog contains a graphic explanation of the Elastic Stop principle, presents test and application data, illustrates uses, and lists the complete line of nuts.

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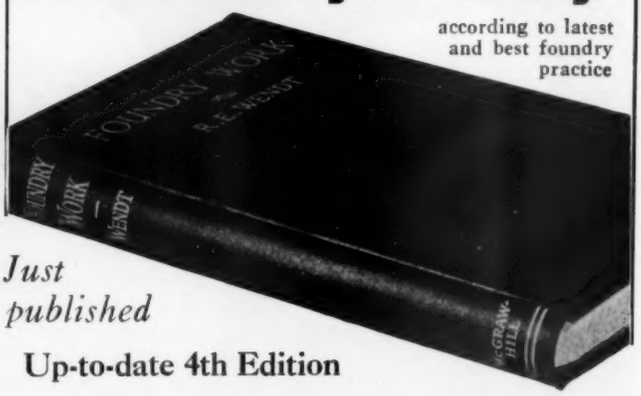
ELASTIC STOP NUT CORPORATION
2351 VAUXHALL ROAD • UNION, NEW JERSEY

Elastic Stop SELF-LOCKING NUTS AND AIRCRAFT FITTINGS

Let a veteran foundry man show you

how to handle every detail in the making of castings

according to latest and best foundry practice



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By **R. E. WENDT, Head Instructor in Foundry Practice, Purdue University. 261 pages, 4¾x7¼, 229 illustrations, $2.00**

HERE is a clear-cut, useful explanation of modern foundry practices, methods and processes. The material plainly and soundly covers the making of all types of castings, describes the apparatus and materials used, and explains the operations and techniques involved. Special material has been added to this edition on bench and floor molding, causes of defective castings and methods of preventing defects, safety precautions, etc. A good deal of down-to-earth attention has been given to problems of foundry management.

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—common gray cast iron
—alloy gray cast iron
—malleable cast iron
—common steel
—alloy steel
—non-ferrous metal

It thoroughly covers everything from fundamentals to what the efficient foundry executive should know in order to solve varied problems — from tools, equipment, sand, flasks, furnaces, fuels, to foundry layout—from cupolas to cleaning and grinding castings.

Latest methods and practical details on:

—foundry layout
—flasks, boards, clamps and weights
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—parting materials
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—dry-sand coremaking
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With the properly engineered use of PARKER-KALON Quality-Controlled Self-tapping Screws you can eliminate many tapping operations – you can save the cost of taps and the expense of maintaining tapping equipment.

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SELF-TAPPING SCREWS

Give the Green Light to Defense Assemblies

SELF-TAPPING SCREWS FOR EVERY METAL AND PLASTIC ASSEMBLY . . . AND OTHER FASTENING DEVICES

FLAMENOL WIRE

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CAN TAKE A BAKE

and Still Be Flexible

THIS MAY BE A TIP FOR YOU

RELAY COILS WITH FLAMENOL LEADS. Operator unloading a batch of coils from baking oven. Switching to Flamenol wire for these leads solved the problem of brittleness.

DO YOUR operations require baking or a varnish treatment of coils and leads? If so, you may find that the use of Flamenol wire for the leads will speed up production by eliminating rejects—as in the following case:

Problem: In one factory the leads of relay coils were coming through with a consistently large number of rejects because of the brittleness of the leads after the regular baking process. A number of representative insulating materials had been tried.

Solution: It was decided to use Flamenol for the leads. Flamenol withstood the 8-hour baking cycle with "practically no change in flexibility." There were no rejects. What is more, in an accelerated aging test (for 105 days) Flamenol was the only suitable wire that could be wound on its own diameter without showing signs of cracking, after the aging test. This is proof of durability for long-time service.

Properly handled, Flamenol may well be useful to you in saving time and overcoming obstacles to increased, efficient production. For helpful information on the right wire or cable for any job, get in touch with the G-E office in your locality, or write to General Electric, Schenectady, N.Y.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

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AMES *Shockless*

Hundred Series

DIAL INDICATORS

For tough jobs, where hammer-like blows at the spindle end break down ordinary indicators, AMES Shockless Indicators stand up and give uninterrupted service. The addition of a simple shock-absorber to the wheel assembly protects the gear train without changing the outside dimensions or appearance. Unlike any other indicator cushioning device, it is absolutely effective, does not reduce accuracy or sensitivity and saves repair expense.

Try some of the various sizes and models on your most punishing testing jobs and see how they will keep on checking fractions of the thousandth inch just as accurately after being pounded and jolted severely.

B. C. AMES CO.

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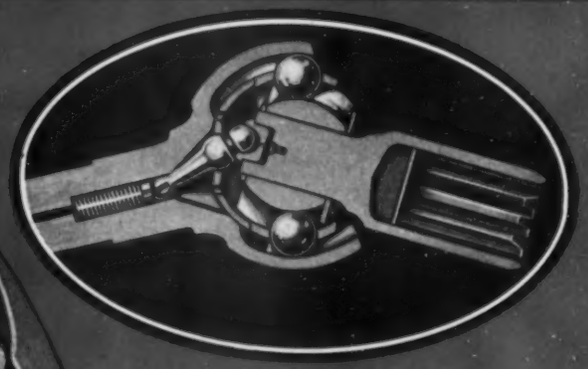
"RZEPPA"



Constant Velocity

UNIVERSAL JOINT

For Military Vehicles

Speed, over unfamiliar shell-pocked, rough terrain—heavy loads, through mud and enemy fire! Yes, the four-wheel, all-wheel drive was needed. And the RZEPPA joint solves one of the most serious problems of mechanized warfare.

From jumping jeep to heavy crash truck, constant velocity power is transmitted to all driving steering wheels through the RZEPPA Constant Velocity Universal Joint—the joint that made "front drive" possible.

Production of these joints in our own factories has been greatly increased, and covers a wide range of sizes, from $\frac{15}{16}$" to 3", shaft size.

Correspondence is invited, covering military as well as non-military applications.

The GEAR GRINDING MACHINE COMPANY

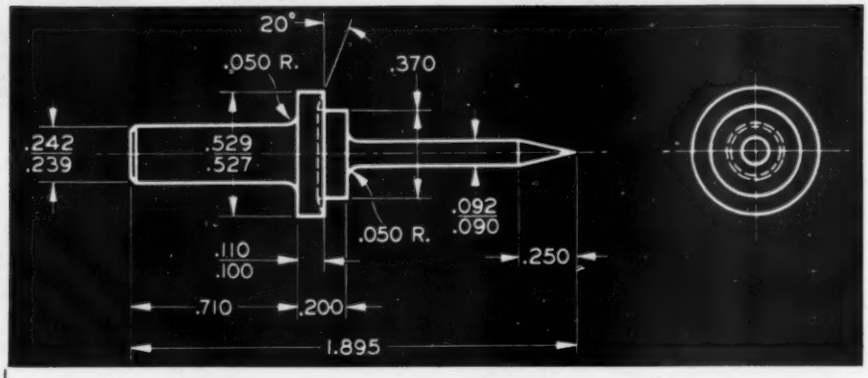
DETROIT, MICH. U.S.A.

Greenlee AUTOMATIC NEWS

PREPARED BY GREENLEE BROS. & CO., ROCKFORD, ILL.

Efficient Tooling Speeds Output of Striker Pins

Greenlee 1″ Automatic Turns Out 276 Pins Per Hour



Typical of the accuracy and speed with which Greenlee Automatic Screw Machines are turning out hundreds of vital defense parts in the United States, England, and Canada, is this story of the production of an English type fuse striker pin on a 1″ six-spindle Greenlee machine.

This job is an excellent example of how the versatility and tooling possibilities of the modern screw machine can be easily adapted to solve many of today's perplexing production problems.

Tooling for Production Efficiency

To eliminate the possibility of difficulty in forming the pointed end of this part, a small box-type roller turner is used instead of the conventional heavy standard roller turner. With this box-type turner, two tools are used, one for turning the small diameter and one for profile turning the point. The one set of rolls in this turner is sufficient to support the piece during these operations.

Another interesting feature of the tooling set-up for this job is the use of a hollow milling tool for undercutting the shoulder which eliminates the need for a special angular cross-working tool.

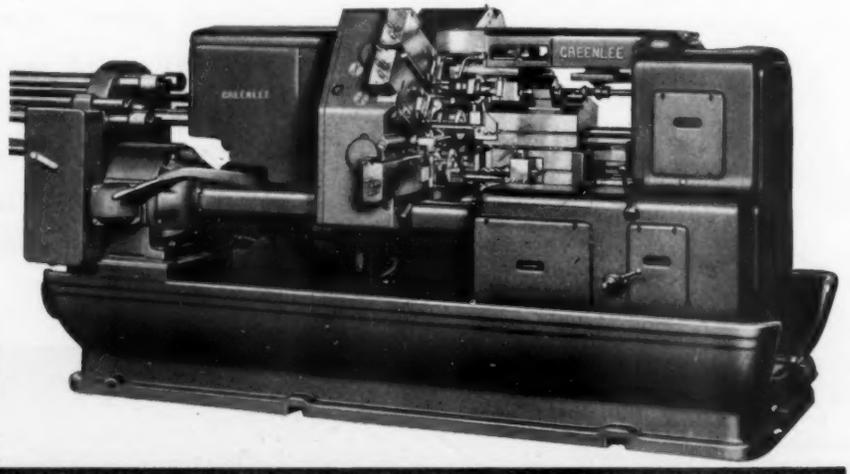
The use of a standard roller turner to finish turn the small .092/.090 diameter probably would result in objectional back-track marks when withdrawing the tool at the end of the cut. It is necessary, therefore, to use another unusual tooling arrangement. A standard die head, operated by a yoke which snaps open the die head at the finish of the cut, is equipped with specially ground chasers to finish-turn this piece.

Production Time Cycle 13 Seconds

The production time cycle for this fuse striker pin, made from 9/16″ round S.A.E. 1112 cold-rolled bars, is 13 seconds. The spindle speed is 1195 R.P.M., the form tool feeds are .0008″ per revolution, with a cut-off feed of .0012″ per revolution for the independently operated cross slides. Turning and endwise-operated tools were fed at .0048″ per revolution.

Sequence of Operations

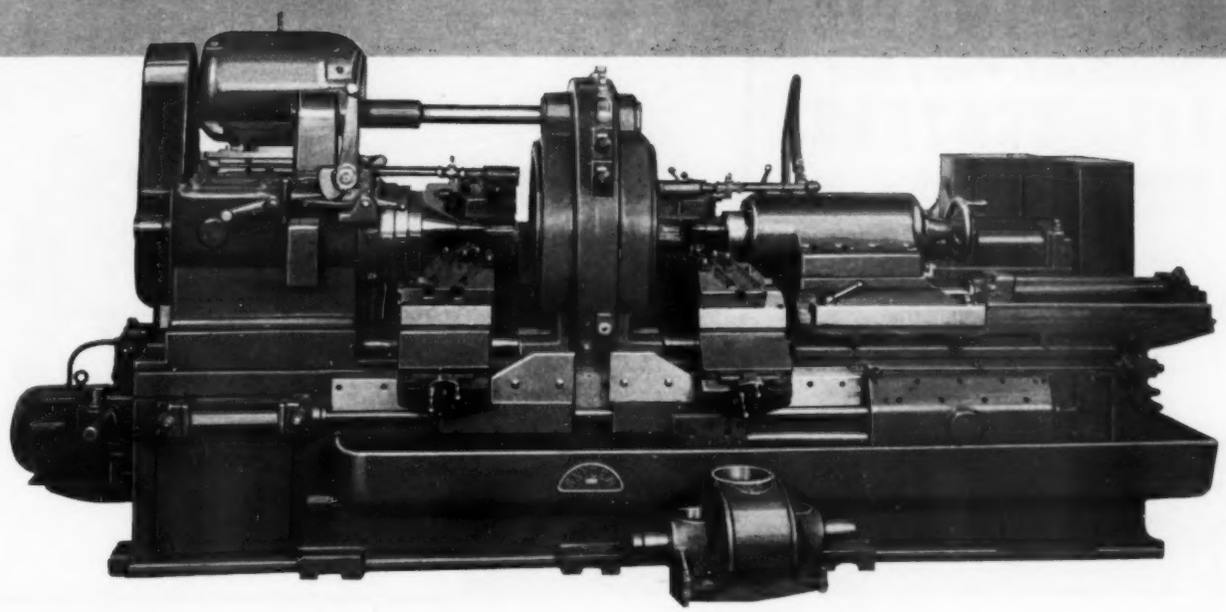
In the first position the .092/.090 diameter and the point is rough turned with the standard roller turner. In the second position the flange diameter was knee turned and the .092/.090 diameter and point were semi-finished turned with a box type roller turner. In the third position the .242/.239 and the .529/.527 diameters were formed, and the shoulder was undercut with a hollow milling tool. In the fourth position, the .370 diameter is faced, the .050 radius is formed, and the striker point is finished, using roller supports ahead of the finish profile turning tools. The .092/.090 diameter is finish turned with the specially arranged die head in the fifth position. The piece is then cut off in the sixth position.



Greenlee BROS. & CO.
ROCKFORD ILLINOIS U.S.A.

MULTIPLE-SPINDLE DRILLING, BORING, AND TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AIRCRAFT PRODUCTION MACHINERY

Removing up to 6 times the amount of stock originally estimated . . . *and Increasing Production 65%*



A SNYDER *Heavy-Duty*, Hydraulic Turning Machine

THIS Snyder Heavy Duty, Double-end Turning Machine illustrates the value of hydraulic feed as applied to turning machines.

In actual operation, this machine is removing up to 6 times the amount of stock originally contemplated, this necessitating TWO heavy cuts instead of ONE heavy and one light cut. But in spite of this, actual production is 65% more than estimated.

The tailstock is provided with a long, hydraulic cylinder to facilitate loading. The right hand front tool bracket, when swung into clearance position, provides a loading platform in line with the locating surface in the center drive.

When the part is loaded and pushed into place between centers, it is clamped manually and the tailstock locked in place, ready for the first of the two turning operations.

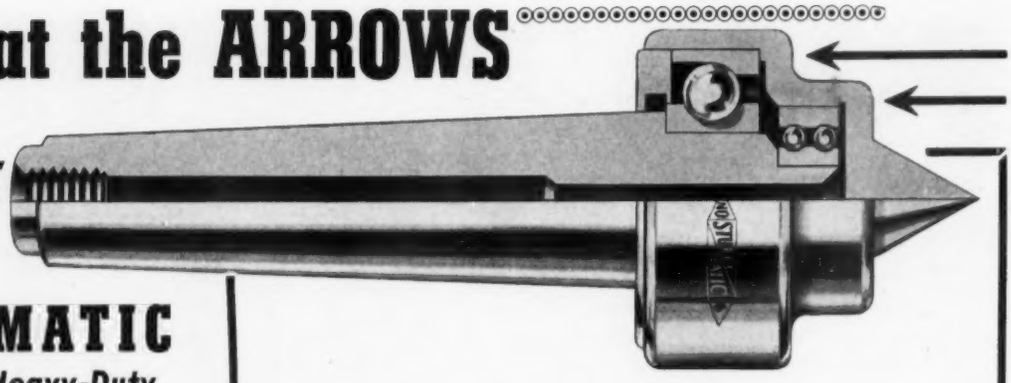
The machine is constructed with very heavy cross-sections in all vital parts and this heavy construction not only contributes to successful operation but also made it possible to step up estimated production by 65%. This increase is achieved in spite of this fact that both front and rear tool blocks are adjusted manually between the first and second cuts.

We invite correspondence regarding your own particular production problems.

SNYDER
TOOL & ENGINEERING CO.
3400 E. Lafayette Ave. • Detroit

designers and builders of machinery for **HIGH** *production at* **LOW** *unit cost*

LOOK at the ARROWS



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High-Speed, Heavy-Duty
LIVE CENTERS

- Eliminate "Dead Center" friction.
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- Minimum overhang.

. . . they point to where the

STURDIMATIC CENTER

Provides Vital Cushioning. This Protects the Bearings from Shock Loads and Thrust Overload Due to Expansion of Work Produced by Heat from Machining.

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5214 THIRD AVE. DETROIT, MICH.

Write for New Illustrated Folder giving complete technical details, specifications, sizes and prices. Standard sizes from stock.

Select your magnetic chucks . . . from the
COMPLETE WALKER LINE

Universal Swiveling Magnetic Chuck for Tool Room

Standard units for practically any service requirement are available from Walker because of the completeness and diversity of the Walker line.

Recognized everywhere for their efficiency and economy in holding work on a wide variety of operations. Walker Magnetic Chucks will help you speed up and cut costs of grinding, milling, planing and turning. If you require special designs, Walker can furnish them.

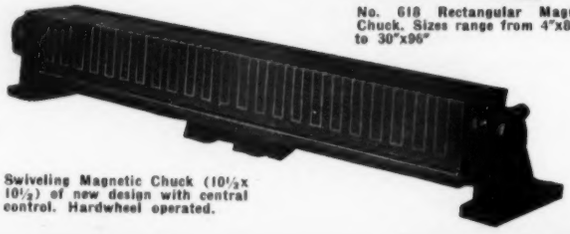
When you come to Walker, you come to specialists having more than thirty-five years experience in the development, design and manufacture of high quality, magnetic chucks of proved performance.

Walker offers a complete range of sizes in Rectangular, Swiveling, Vertical Face and Rotary types.

Our illustrated bulletin W4 contain valuable information for user of magnetic chucks. Write today. Ask Walker engineers to help you select the chuck you need for your specific service.

No. 618 Rectangular Magnetic Chuck. Sizes range from 4"x8" up to 30"x96"

Style D Face Plate. "Concentric Gap" Type



Swiveling Magnetic Chuck (10½x 10½) of new design with central control. Hardwheel operated.

***Have you the* WALKER CATALOG**

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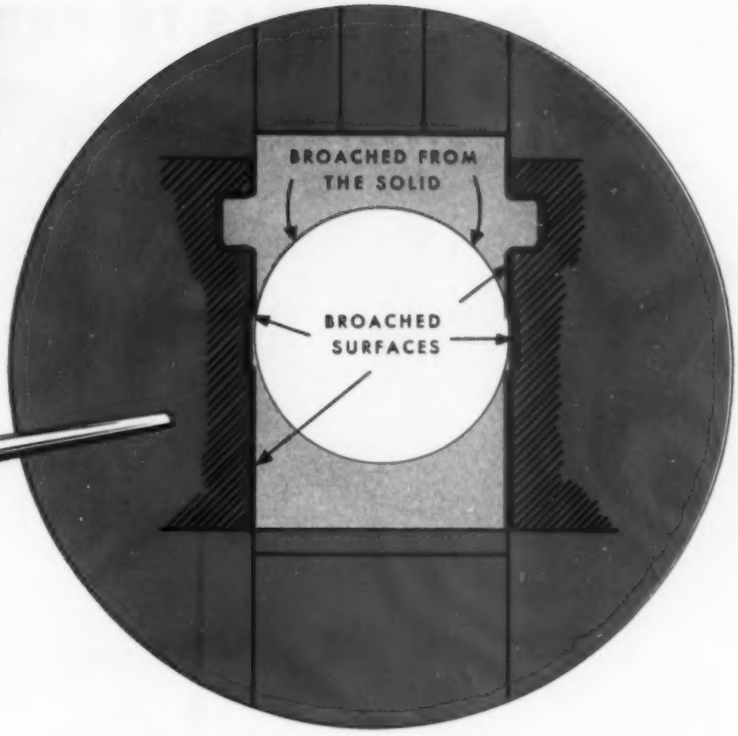
WORCESTER, MASS.

Completed
In ONE-EIGHTH THE TIME



with DETROIT BROACHES

● The surfaces shown in actual contour in the above sketch are those broached in the breech housing of a naval gun.

By methods formerly employed in producing the part, portions of it were milled and the remainder were shaped. The surfaces were finished by hand scraping. By broaching the job is done IN ONE-EIGHTH THE TIME required for the operations previously employed.

Never before has speed in production been so vitally important. Broaching with Detroit Broaches can assure faster, more accurate results on many of your metal-cutting operations.

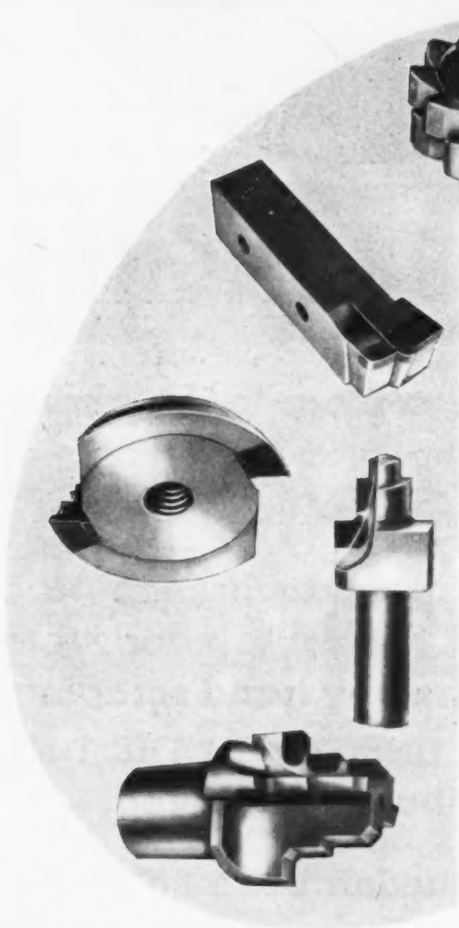
DETROIT BROACH COMPANY
20201 SHERWOOD AVENUE • DETROIT, MICHIGAN

TOOLS TO ORDER . . . *Finish Ground*

METHOD 3 Vascoloy RAMET

T. M. REG. U. S. PAT. OFF.

5-METHOD COMPLETE TOOL SERVICE *for* MAXIMUM PRODUCTION



Typical Precision Tools Made to Order

Every user of cemented carbide tools on a broad scale has some need for tools that cannot be taken care of from any standard, however inclusive. Such tools must be made to customer's order to suit particular requirements. Included in this classification are Ramet Tantalum-Tungsten Carbide tipped single point tools, milling cutters, special form tools, boring heads, circular form tools, reamers, etc.

These tools are made complete, including tipping with any of over a dozen grades of Ramet Cemented Carbide Blanks and finish ground ready to use. We build these tools according to your design, or design them from a description of the cutting conditions to be met. Very often their design involves the consideration of factors that results in tools quite different from the conventional design. We have men with broad experience in just this application of cemented carbide tools.

It pays to use the Vascoloy-Ramet 5 Method Complete Tool Service for Maximum Production.

VASCOLOY-RAMET CORPORATION

NORTH CHICAGO, ILLINOIS

DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES

IN CANADA: Carbide Tool & Die Company, Ltd., Hamilton, Ont.

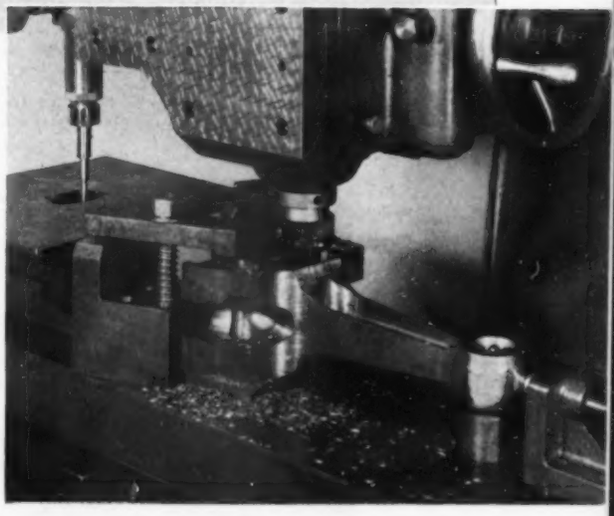
4228

TANTALUM-TUNGSTEN CARBIDE

FOR TOOL SERVICE . . . . . *Specify* Vascoloy RAMET TOOLS

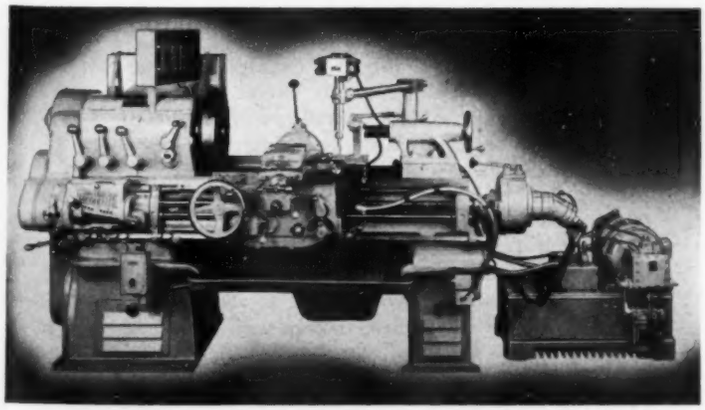
TANTUNG "G"

Speed Work Improve Quality!



Speed of work and a constant adherence to quality . . . is a program that Reed-Prentice endorses heartily. We recommend Reed-Prentice Toolroom Lathes and Vertical Millers with Detroit Universal Duplicators for increased production.

The accuracy of this Detroit Duplicator, together with the usual precision of Reed-Prentice machine tools, serves to reproduce faithfully and faster any irregular form that can be machined.



If you have a rejection problem in parts production, Reed-Prentice Lathes and Millers, together with the Detroit Universal Duplicator, will solve that problem even though an unskilled operator is handling the work.

REED-PRENTICE CORPORATION 1213 W. 3d St., CLEVELAND, OHIO
75 WEST ST., NEW YORK CITY

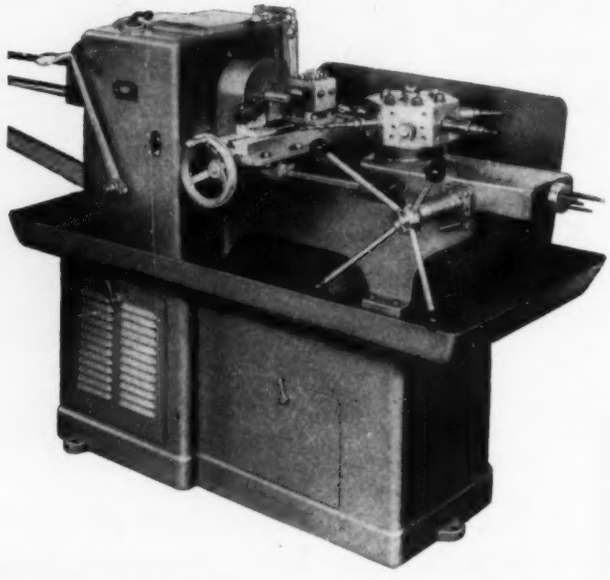
WORCESTER, MASSACHUSETTS, U.S.A.

Detroit Distributor: KORDENBROCK MACHINERY COMPANY

SIX IMPORTANT ADVANTAGES GAINED WITH OSTER No. 601 SIMPLIFIED TURRET LATHE

The Oster No. 601 SIMPLIFIED Turret Lathe meets today's urgent needs for a low cost, motor driven bar and chucking machine for a wide range of small diameter jobs not requiring complicated, costly equipment or highly skilled set-up men and operators.

For complete details, fill out form below and mail. A copy of illustrated Catalog No. 27-A will be sent to you promptly.



1 **Release your more complicated, costlier machines for other work.** The Oster No. 601 Turret Lathe has proved its efficiency on a wide variety of bar and chucking operations in the small diameter range up to 1½-inch.

2 **Release your highly skilled set-up men and operators** for work demanding their expert services. The Oster No. 601 Turret Lathe has hand feed to cross slide and manually operated, six station turret.

3 **Speed up training of new operators.** The simplified design and operation of the Oster No. 601 Turret Lathe saves months in training new men to high standards of efficiency.

4 **Maintain flexibility for quick change-overs** from job to job. For example, a battery of six Oster No. 601 Turret Lathes permits using all six machines on identical work, or, at any time, releasing one or more of the six machines for different work.

5 **Obtain quicker deliveries of Oster No. 601 Turret Lathes** and eliminate costly delays waiting for shipments of more complicated machines which you may need now but can't get for months to come.

6 **Save money on initial investment in machinery.** The Oster No. 601 Turret Lathe equipped with optional *worm drive* or *direct drive* and *six station turret* costs less than $2000 without tools and fixtures.

THE OSTER MFG. CO. • 2049 East 61st St., Cleveland, Ohio

Rush, by return mail ..... copies of Catalog No. 27-A which contains full description and detailed illustrations of No. 601 Turret Lathe.

NAME .....

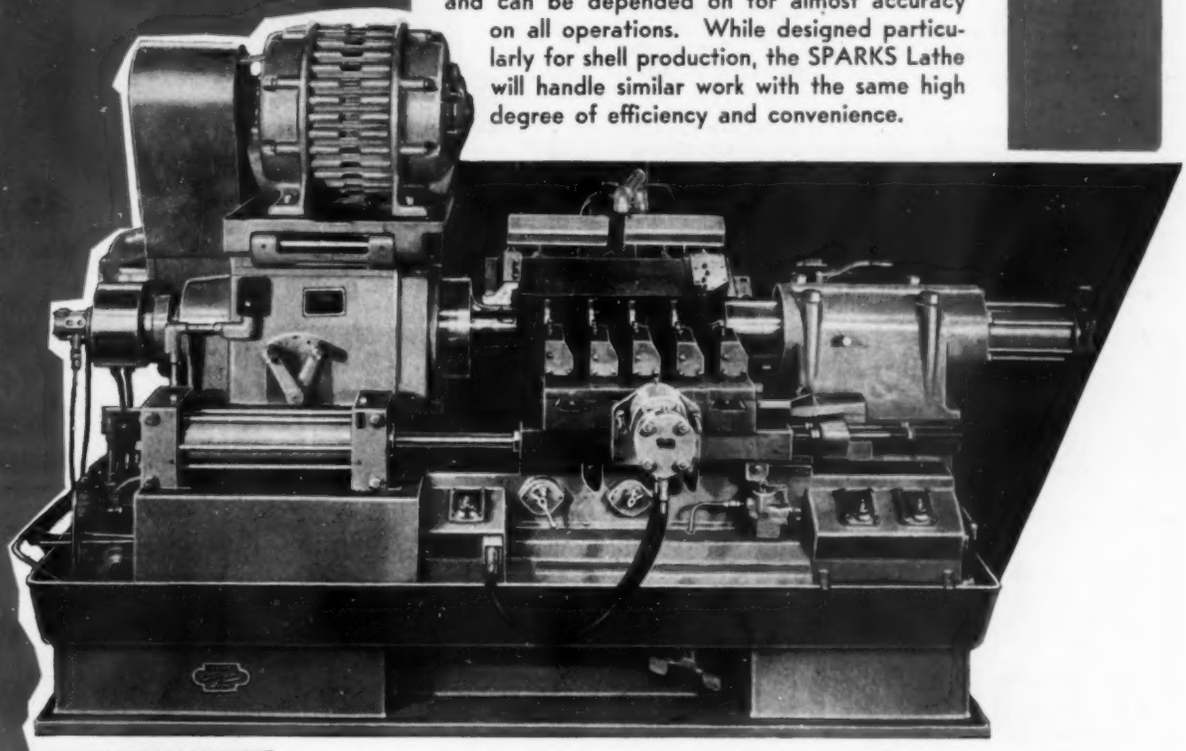
ADDRESS .....

CITY ..... STATE .....

The SPARKS SEMI-AUTOMATIC HYDRA-FEED LATHE

CAN BE DEPENDED ON FOR *FAST SHELL PRODUCTION*

Fast, sturdy and highly productive, this new machine is equipped for automatic operation and can be depended on for almost accuracy on all operations. While designed particularly for shell production, the SPARKS Lathe will handle similar work with the same high degree of efficiency and convenience.



FAST TURNING TIME

With machine set up for a 155 M/M shell, as shown in illustration, the rough turning time is only 69 seconds. This set up involves the use of 7 tools and a cutting speed of 310 feet per min. A 5/16" to 1/2" cut is taken on the front tools using a .054" feed; a 1¼" facing cut is also taken on the base end with a feed of .028". Only 2 manual operations are involved during the complete cycle.

CONDENSED SPECIFICATIONS

Swing over ways 21".
Swing over carriage 11½".
Extreme distance chuck to tail center 33".
Length of bed 7'-6".
Geared head stock providing 4 speeds.
Forged steel ground spindle mounted on Timken bearings.
Hole through spindle 2½".

HANDLES ALL ROUGHING AND FINISHING OPERATIONS ON 75 M/M TO 8" SHELLS

Set up for shell work, the following sequence of operations take place:

1) Rough turn body of shell, face base end and cut off to length.
2) Bore and chamfer, ream and chamfer, and recess.
3) Finish turn outside of body and finish turn nose contour to bourrelet.
4) Finish face base and finish turn band seat.
5) Machine rotating band.

WRITE FOR COMPLETE DETAILS

SPARKS HYDRA-FEED LATHE

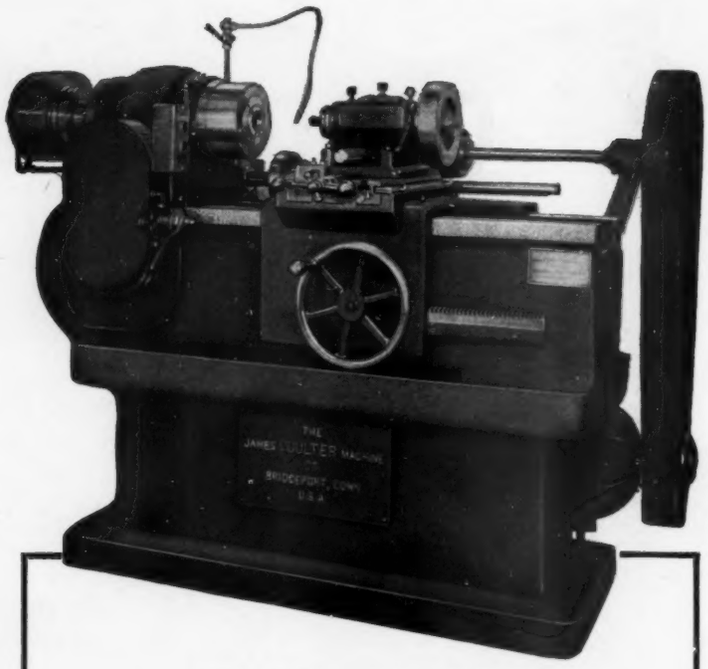
SPARKS MACHINE TOOL CORPORATION
NORWALK . . . . CONN.

Keep Ahead of
DEFENSE DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.



Send for Descriptive Bulletin giving full information.

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

WILLARD Spring TOOL HOLDERS

FINER QUALITY WORK AND FASTER CUTS—ASSURED WITHOUT CHATTER OR DANGER OF TOOL BREAKAGE . . . . . .

Willard Tool Holders have been specially developed to save time and insure precision on high production repetitive work such as that demanded in shops busily engaged in AUTOMOTIVE, AIR CRAFT and DEFENSE MANUFACTURING.

They are available for a wide number of operations and hold tools securely against chatter. Cutter breakage is eliminated and the possibility of damaged work reduced to a minimum.

PROMPT DELIVERIES

Write today for descriptive folder which gives details on Willard Tool Holders for Forming, Threading and Forming Tools, Cutting Off Tools and Threading Tools.

Cutting-off Tool Holders reduce cut off time in half over solid tools. Spring feature makes faster feeds and heavier cuts safely possible.

Forming Tool Holders—adapted to a wide range of work in lathes, shapers and screw machines. Any number of cutters can be used in the same holder.

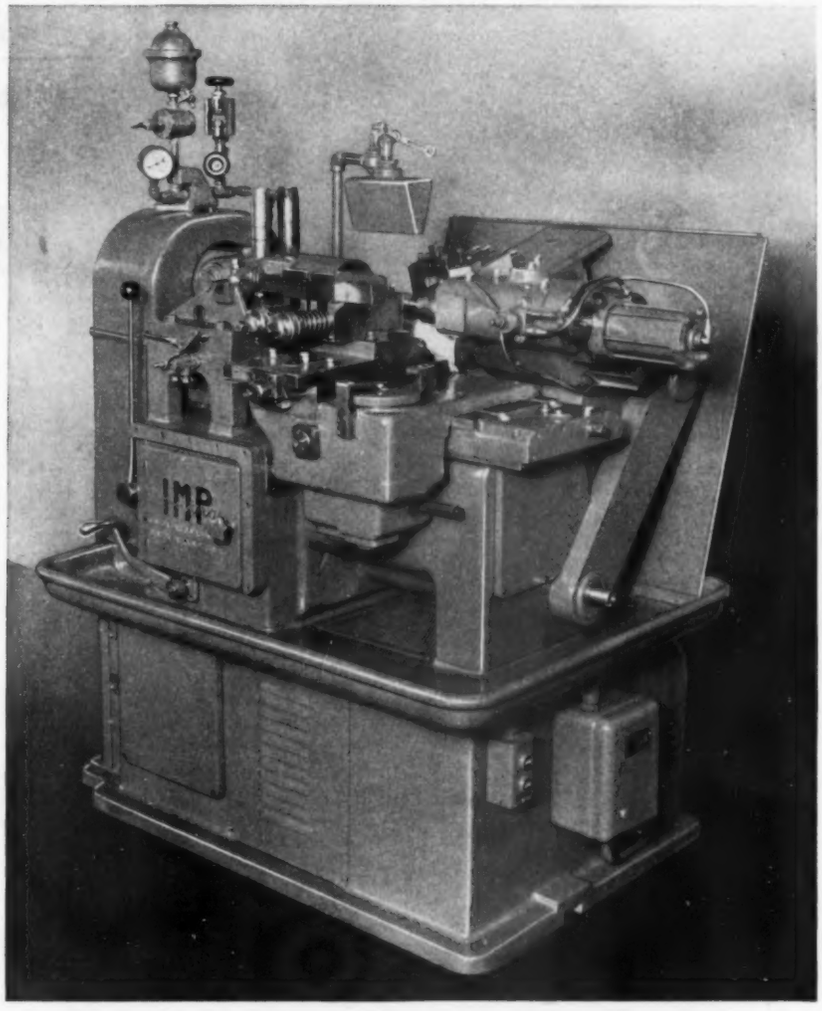
Forming Tool Holders — with straight and right hand offset—for holding ground high speed cutters. Fast, smooth cutting assured free from cutter marks. Ratchet design prevents cutter from turning under heavy feeds.

WILLARD TOOL DIVISION
AUTO-ORDNANCE CORPORATION
1437 Railroad Avenue — Bridgeport, Conn.

MACHINE OF THE MONTH

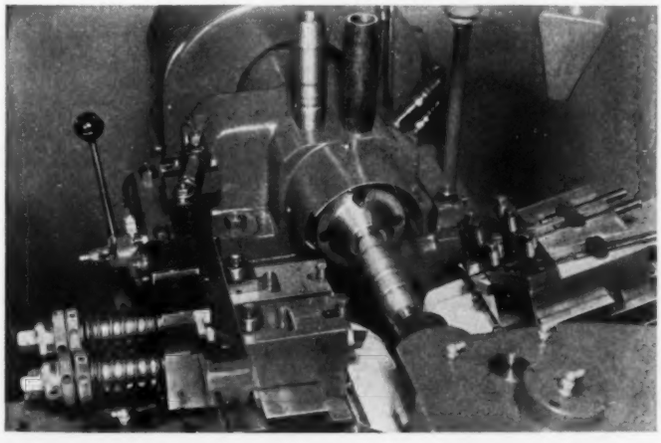
PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

Lo-swing IMP LATHE FINISH TURNS 40 MM SHELL IN ONE OPERATION



PROBLEM: To finish turn 40 mm high explosive shells, approximately 1.57″ diameter x 5.17″ long, maintaining close concentricity between O D and bore and obtaining an accurate, high-class finish.

SOLUTION: The Automatic Lo-swing IMP Lathe was chosen for this work because its spindle construction with direct "V" belt drive permits turning with sintered carbide tools at the very high surface cutting speeds necessary to assure a polished finish.



Close-up of tooling with covers removed on template-controlled tool blocks to show construction. Note rough and finish turned pieces on headstock. Work is first drilled, reamed and ends rough bevelled on an 8-spindle automatic lathe before coming to the IMP.

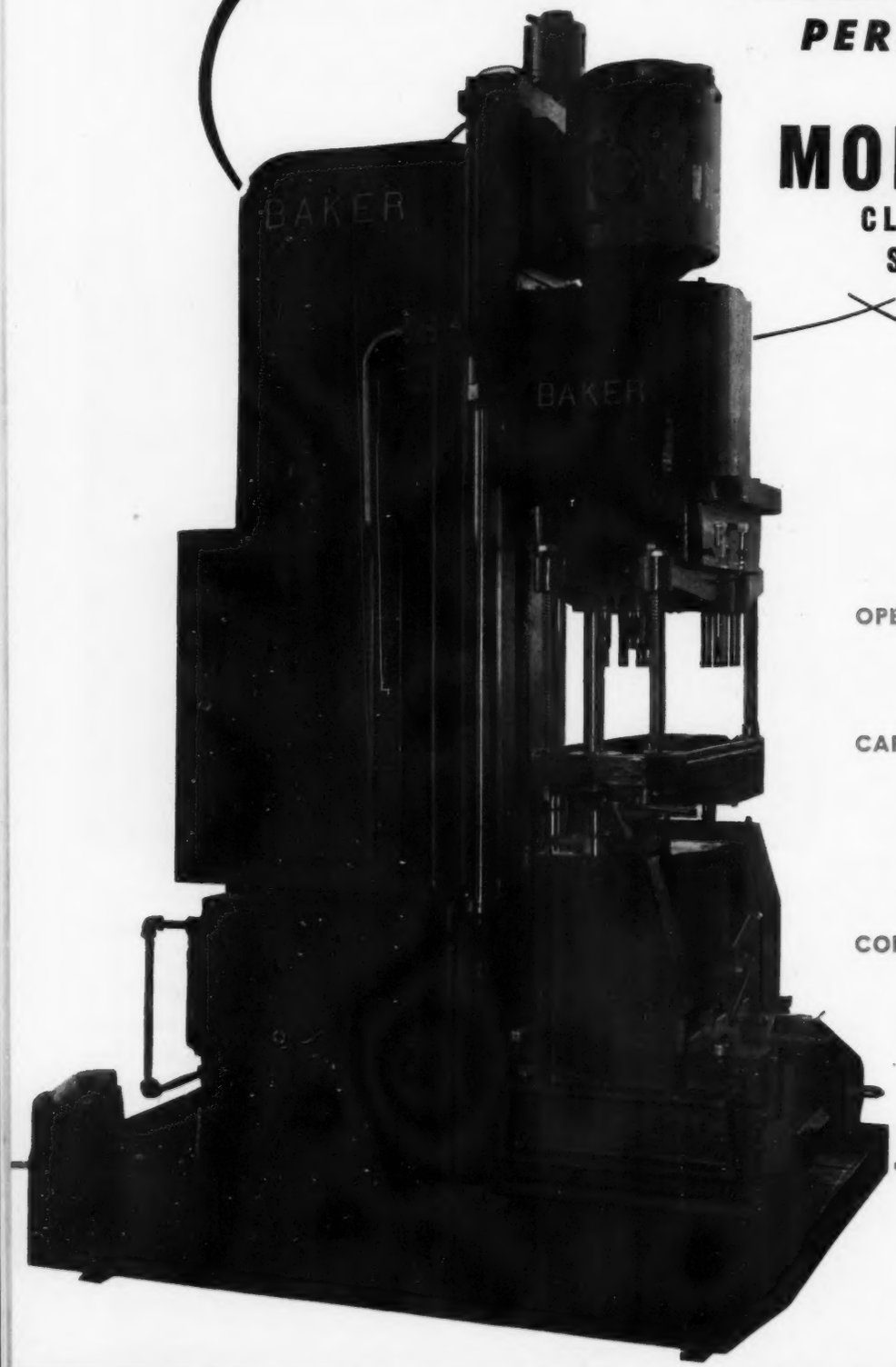
Also, other features of IMP design assured the rigidity and turning accuracy which this job demanded.

The work is held and driven at the head end by an air-operated expanding collet chuck. The tailstock end is supported by a revolving, expanding bushing which enters the small diameter bore. The O D is turned the full length of the piece with 2 template-controlled tool blocks — finish turning the nose, the boat tail and the cylindrical body. Simultaneously, a 3-tool block on the automatic back squaring attachment faces and chamfers one end and machines the cartridge crimping groove.

Movements of both front and rear slides are synchronized and the machine stops automatically with tools and slides returned to starting position. The tailstock is air-operated to speed-up handling time.

BAKER

. . . PROVIDES SPEEDY, VERSATILE PERFORMANCE WITH THE MODEL 26-HO CLEANLINE HEAVY-DUTY SINGLE and MULTIPLE SPINDLE DRILL!



This Model 26-HO Cleanline clearly demonstrates the advantages of the application of a basic standard unit, properly tooled-up to produce more for less. Check the operational, capacity and construction data below . . . then figure how one or more of these BAKERS on your production line can help you solve your current problems. Write for new circular, giving complete data!

OPERATION:

The MODEL 26-HO handles heavy-duty single and multiple spindle operations. There are two machines in this model . . . suited to drilling, boring, counterboring, facing, forming and recessing operations.

CAPACITY:

The 26-HO has a maximum capacity of 3" dia. drill in solid S.A.E. 1035 steel, and takes up to a 15 H.P. motor for drive to head. Standard, the 26-HO has two cylinders of 3¼" bore, giving a feed pressure of 18,500 lbs. and a rapid traverse of 195" per minute. At no extra cost, special 3¼" bore cylinders can be provided . . . feed pressure is reduced to 14,680 lbs., but rapid traverse speed is increased to 275" per minute.

CONSTRUCTION:

Streamlined, with all major units enclosed—to provide safety and greater cleanliness. GEAR BOX mounted direct on feeding saddle, with PICK-OFF GEAR provision. HYDRAULIC FEED, saddle type, with Baker patented Twin Pull feed cylinder mounting. MAIN SPINDLE SPEEDS and DRIVE from motor mounted above head—a wide range of speeds available. LUBRICATION is automatic. TABLES either box type or plain—special to meet your needs. CUTTING COMPOUND attachments with pumps can be furnished.

Here's a Model 26-HO Cleanline unit tooled up with a multiple spindle head and special cross index fixture for multiple operations in oil sump as used on radial aircraft engines. The machine handles drilling, reaming and counterboring operations in this magnesium casting.

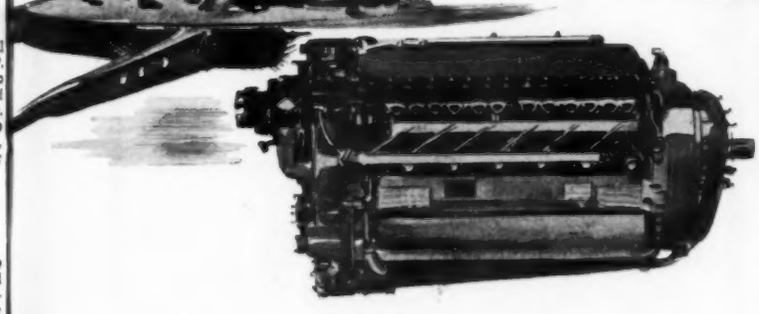
BAKER BROTHERS INC. Toledo, Ohio, U.S.A.

OUR MOTTO SINCE 1867
"MACHINES: STURDY and EFFICIENT, AS FINE AS CAN BE BUILT . . ."

DRILLING • BORING • TAPPING AND KEYSEATING MACHINES

FOR THE *Toughest* JOBS IN *every* METAL WORKING INDUSTRY

AXELSON *HEAVY DUTY* LATHES

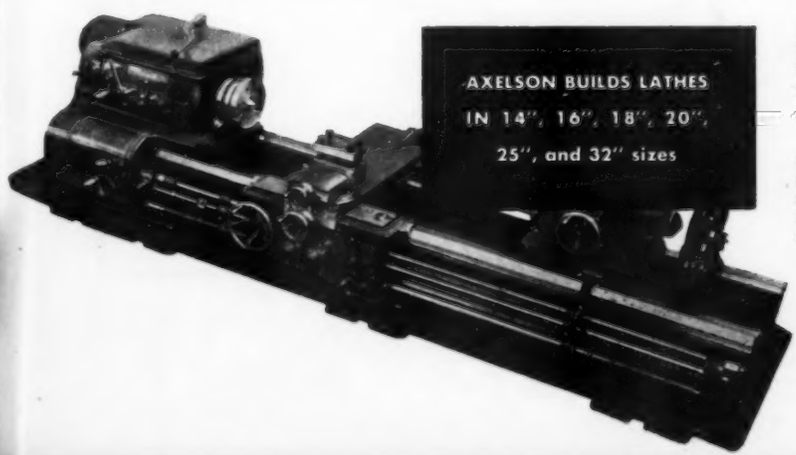


The metal working industry has been called upon to meet an ever growing demand for war supplies. The answer, "It shall be done," calls for speed, precision, and accuracy. A tough job indeed but scores of plant operators have found that their Axelson Lathes are fulfilling their assigned tasks *effectively* and *economically*.

Axelson Heavy Duty Lathes are built by master craftsmen to give three essentials of lathe operations. First: they offer a wide range of speeds and feeds necessary to meet *fast* production. Second: the accuracy and rigidity have been established under actual *performance records* and, third: cost records prove they run smoothly year after year with minimum of maintenance costs.

From motors to ships—from guns to airplanes in plants from coast to coast you'll find Axelson Lathes "on duty" around the clock. They are helping plant operators *increase* daily *output* at *lowest cost* per man hour. It will pay to get complete information on sizes and specifications of Axelson Heavy Duty Lathes. No obligation. Send for newest Axelson Lathe Bulletins.

BEFORE YOU BUY ANY LATHE INVESTIGATE *AXELSON*



AXELSON MANUFACTURING COMPANY
6160 Boyle Avenue (P.O. Box 98, Vernon Station), Los Angeles, California
50 Church Street, New York — 3844 Walsh Street, St. Louis

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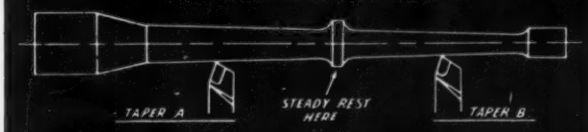
LOS ANGELES.....Griffin & Ross Machinery Co.

AXELSON 50th YEAR 1892 1942

25 MORE GUNS PER GRIND



TAPER A
Tool: 11T70 Grade KM — 15° SCEA — 30° ECEA
Speed: 245 RPM — 210 to 235 FPM
Feed: .0225"/ Rev.
Length of Cut: 28"
Depth of Cut: 1/8"

TAPER B
Tool: 11T70 Grade KM — 15° SCEA — 30° ECEA
Speed: 296 RPM — 158 to 235 FPM
Feed: .0225"/ Rev.
Length of Cut: 34"
Depth of Cut: 1/8" to 3/16" average

★ ★ ★

with KENNAMETAL tools

STYLE 11 TOOL

In finish machining heat treated alloy steel gun barrels, KENNAMETAL Style 11 tools completed an average of 40 pieces per grind, as compared to an average of 15 pieces per grind completed by competitive carbide tools. That fact means KENNAMETAL saved hours of "down time" for the manufacturer, helped him to produce *more* guns *more* quickly.

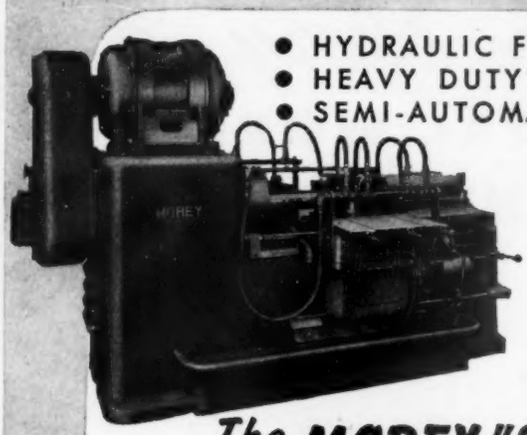
The superior strength and hardness of KENNAMETAL permit greater machining speeds and removal of more metal between grinds than other carbides. If you machine steels in hardnesses up to 550 Brinell, KENNAMETAL tools can turn "down time" into production time for you.

KENNAMETAL
The Accepted
STEEL CUTTING CARBIDE

WRITE FOR THE KENNAMETAL VEST POCKET MANUAL

McKENNA METALS Co.
109 LLOYD AVENUE, LATROBE, PA.

Suitable for 105 M.M. to 155 M.M. Shells



- HYDRAULIC FEED
- HEAVY DUTY
- SEMI-AUTOMATIC

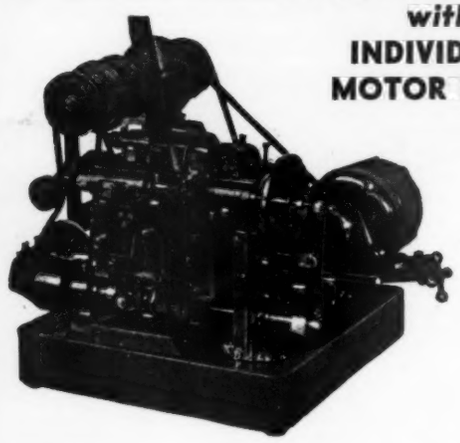
The MOREY "27" SHELL LATHE

Timken Tapered Roller Bearings for Main Spindle—All Others Anti-Friction

The HYDRAULIC FEED insures an almost effortless operation. Rigid enough to use carbide tools to their full capacity—entirely self-contained—no outside or auxiliary equipment required! Details in Circular 715—ask for it.

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

WALTHAM *MAGAZINE Fed* PINION CUTTERS *with* INDIVIDUAL MOTOR DRIVE



INSURE
Great Accuracy Smoothness and Production. . . .

•

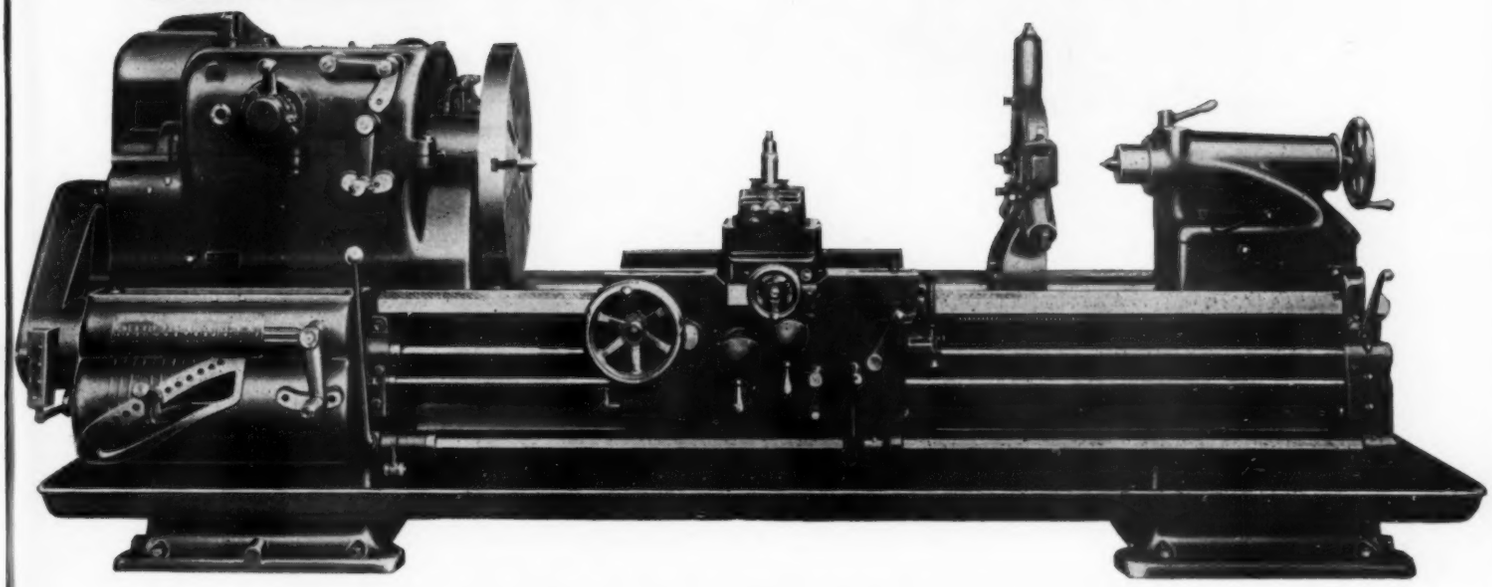
Improved in design, Waltham Pinion Cutters achieve not only great accuracy and smoothness of work but also steps up production.

The magazine feed may be omitted and fine pitch gears up to 1½" diameter may be cut in a stack about 1" long.

A countershaft for group drive can be supplied if preferred. Bench space requires 20"x22". Write for further details.

WALTHAM MACHINE WORKS
HIGH STREET **WALTHAM, MASS.**

FOR WAR PRODUCTION...



SPRINGFIELD

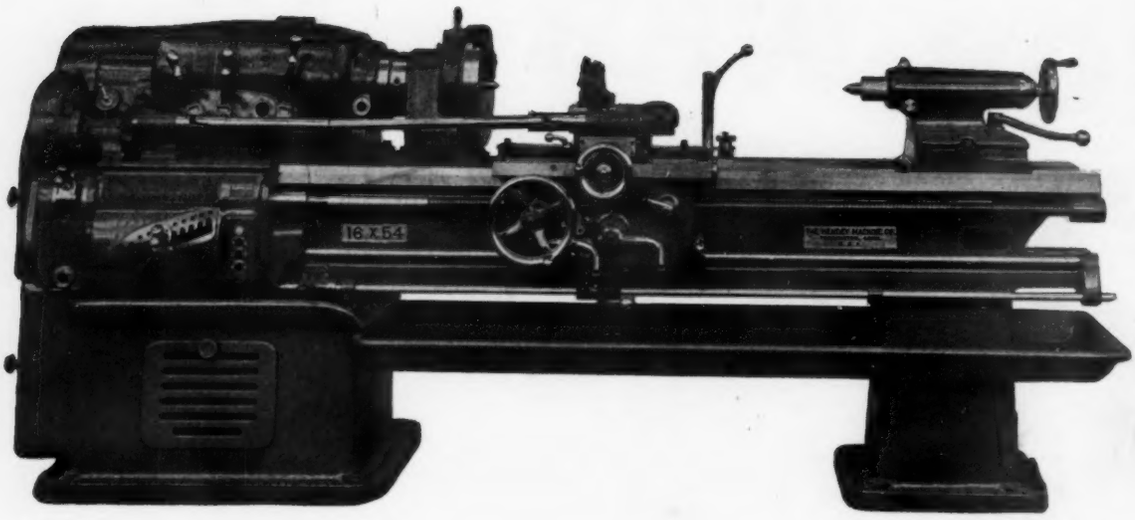
Geared Head Lathes

● In the Machine Tool industrys current expansion program to increase production, SPRINGFIELD Geared Head Lathes are playing a prominent role . . . in ever greater numbers, SPRINGFIELDS are being tagged "FOR WAR PRODUCTION". In turn, this demand has caused us to expand our own facilities and services to turn out more lathes, so that more guns, tanks, airplanes and other fighting tools can be economically and efficiently produced.

As always, those saving features of SPRINGFIELD Geared Head Lathes—maximum gearing efficiency . . . ingenious attachments . . . rugged construction . . . superior lubricating and power transmission systems, and many more — are showing themselves to be the answer to many problems, particularly where sustained production is the order of the day. For War Production now, and normal operations later, choose SPRINGFIELD—Geared Head Lathes in sizes from 14" to 30". Write for circular #162, concerning prices, delivery dates, etc.

The SPRINGFIELD MACHINE TOOL Co.

SPRINGFIELD OHIO U.S.A.



HENDEY

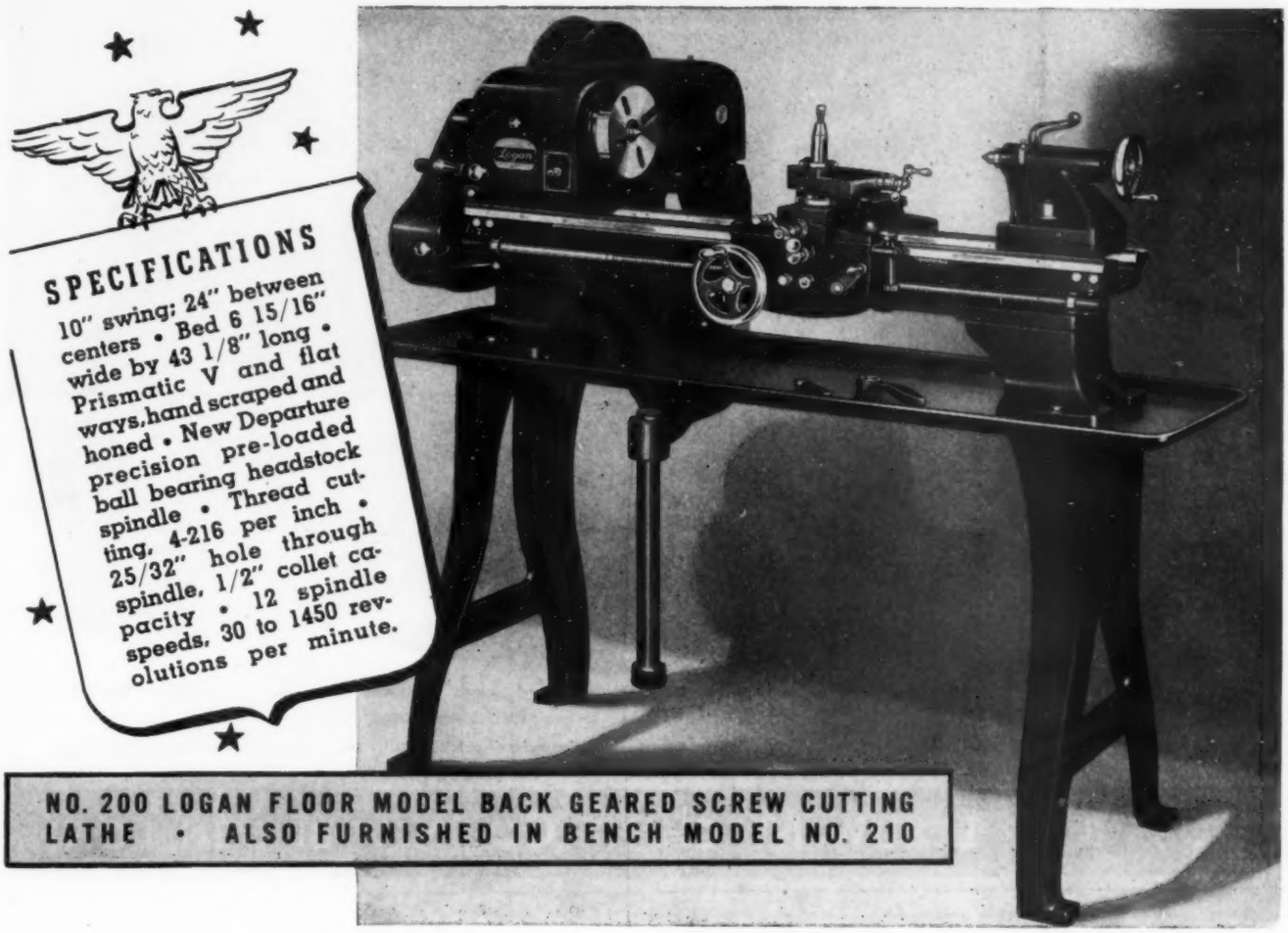
The Hendey lathe as illustrated is equipped with sub headstock and relieving attachment. With this equipment it is capable of

Chasing screw threads having very long leads;
Turning and relieving wide forming cutters;
Turning and relieving hobs with long leads;
Relieving milling cutters with large numbers of teeth;
Turning work on dead centers.

And it is still a 100 percent Precision-Production lathe capable of taking care of every variety of work which may be done in an engine lathe.

THE HENDEY MACHINE COMPANY, TORRINGTON, CONN.

BOSTON NEW YORK ROCHESTER DETROIT CHICAGO


SPECIFICATIONS
10" swing; 24" between centers • Bed 6 15/16" wide by 43 1/8" long • Prismatic V and flat ways, hand scraped and honed • New Departure precision pre-loaded ball bearing headstock spindle • Thread cutting, 4-216 per inch • 25/32" hole through spindle, 1/2" collet capacity • 12 spindle speeds, 30 to 1450 revolutions per minute.

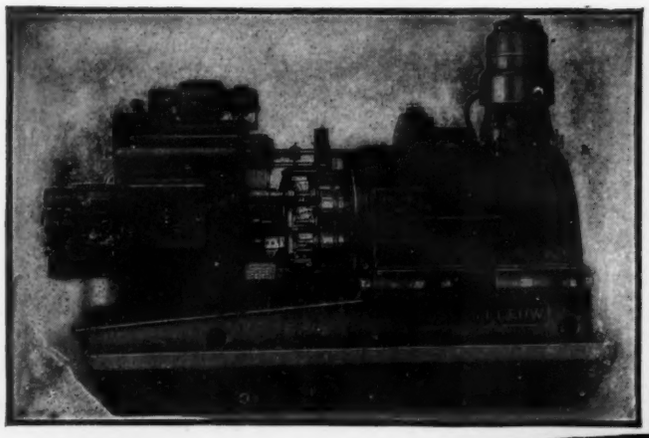
NO. 200 LOGAN FLOOR MODEL BACK GEARED SCREW CUTTING LATHE • ALSO FURNISHED IN BENCH MODEL NO. 210

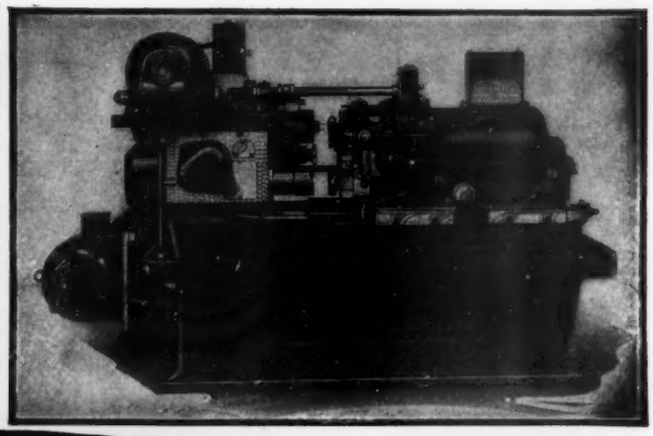
A Logan Lathe is a "PLUS" Investment

Advanced streamline design and sturdy construction is your first impression of the No. 200 Logan Lathe. Further study presents convincing evidence of higher engineering standards, better workmanship and a wealth of added features — all of which will pay you extra dividends in continuous precision performance and better shop satisfaction.

LOGAN ENGINEERING COMPANY • Chicago, Illinois

Logan A NAME TO REMEMBER WHEN YOU THINK OF LATHES





WORK ROTATING TYPE

5 Spindles
6 Spindles
8 Spindles

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES

TOOL ROTATING TYPE

4 Spindles
5 Chucking Positions

On these machines, two threading operations can be handled simultaneously, each thread controlled by its own lead screw.

Among the many other modern features offered in both types are: pre-loaded anti-friction spindle bearings, hardened ways, oversize spindles and gears of chrome-nickel steel, heat-treated.

Complete details will be found in descriptive catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

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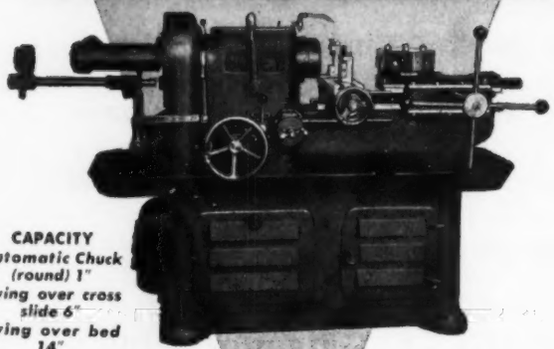
for ECONOMY—for HIGH SPEED PRODUCTION

The MOREY 2G
Back-Geared
TURRET LATHE
Timken Bearing
Self-Locking Turret and Infinite Spindle Speeds



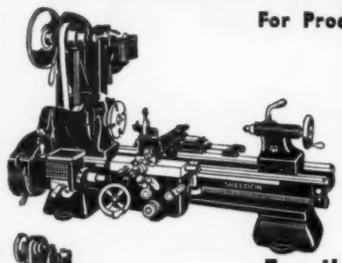
CAPACITY
Automatic Chuck (round) 1"
Swing over cross slide 6"
Swing over bed 14"

Thousands of the MOREY 2G Turret Lathes are saving money with no sacrifice of high speed production. Economy features: Back Gears are instantly thrown in through extra large Twin Disc Clutch—Full advantage from high speed and carbide tools—Vibrationless precision and an infinite variety of spindle speeds for every job—Timken bearing—Self-locking turret. Can be furnished with tooling.

Ask for Circular 629 for full details

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

SHELDON Back Geared Screw Cutting PRECISION LATHES



For Production

Sheldon Lathes will stand up to any production work within their capacity—are ideal for second operation work. Production models available with any or all of these features: Ultra-Precision Ball or Super-Precision motor spindle bearings, Lever-operated Collet Attachment, Lever-operated Tail Stock, Lever-operated cross slide with double tool post. Lever-operated turret, etc.

For the Tool Room

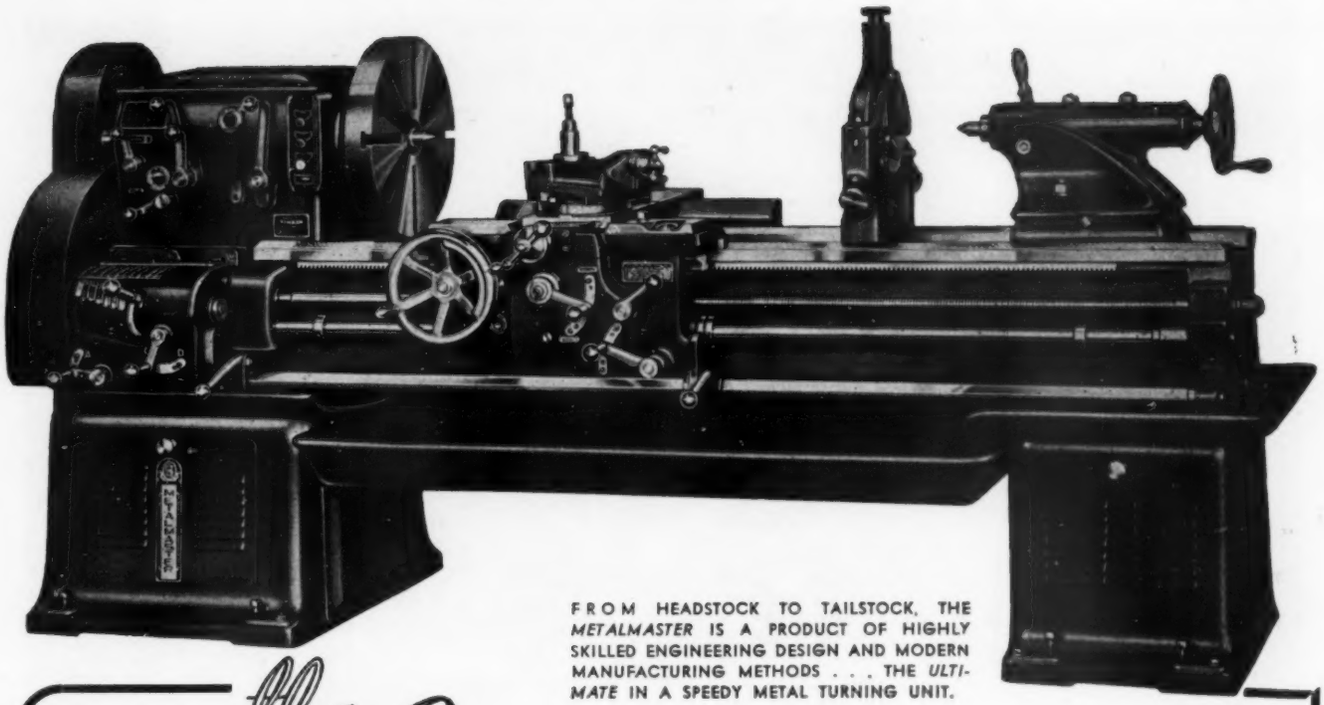
The finest 10", 11" and 12" lathes ever built in the moderate price field. Large special analysis steel spindles GROUND ALL OVER, with extra collet capacity. Hand-scraped Bronze, Ultra-Precision Ball or Super Precision Roller spindle bearings, (the finest bearings obtainable). Heavy braced, semi-steel beds with hand scraped ways (2 V-ways and 2 flat ways) These lathes come with a choice of aprons, gear boxes, and drives including the anti-friction, 4-speed, V-belt Lever-operated pedestal base motor drive illustrated. Telescopic Taper Attachment and other accessories available.

For Machine Shop

Both Bench and floor models with choice of Semi-quick or Full-quick Change Gears, Plain Aprons or Worm Feed Apron with Power Cross Feed, Overhead, Back or Underneath Motor Drives—Telescopic Taper Attachments, Tool Post Grinders, Milling attachments and all standard accessories.

Write for Catalog and name of nearest distributor.

SHELDON MACHINE CO., INC.
4234 N. KNOX AVE. CHICAGO, U. S. A.



FROM HEADSTOCK TO TAILSTOCK, THE *METALMASTER* IS A PRODUCT OF HIGHLY SKILLED ENGINEERING DESIGN AND MODERN MANUFACTURING METHODS . . . THE *ULTIMATE* IN A SPEEDY METAL TURNING UNIT.

The Metalmaster

IS SPECIALLY BUILT TO MEET TODAY'S "OVERTIME" REQUIREMENTS . . .

. . . . CHECK THESE STRENGTH FEATURES

• THE METALMASTER CARRIAGE is soundly constructed, and has exceptionally long wings, carefully planed and hand-scraped to a full length bearing. Clamp located on the right front wing locks carriage during facing operations. Bridge is wide and heavy, with a large dovetail section for the cross slide. Chasing dial, located so as to be convenient for the operator to read, is an integral part of the carriage. Rear of carriage is planed and tapped so that taper attachment can be added at any time. Synthetic rubber wipers keep dirt and chips out of bearing. Large dials (reading in thousandths) are on both cross slide and compound rest feed screws.

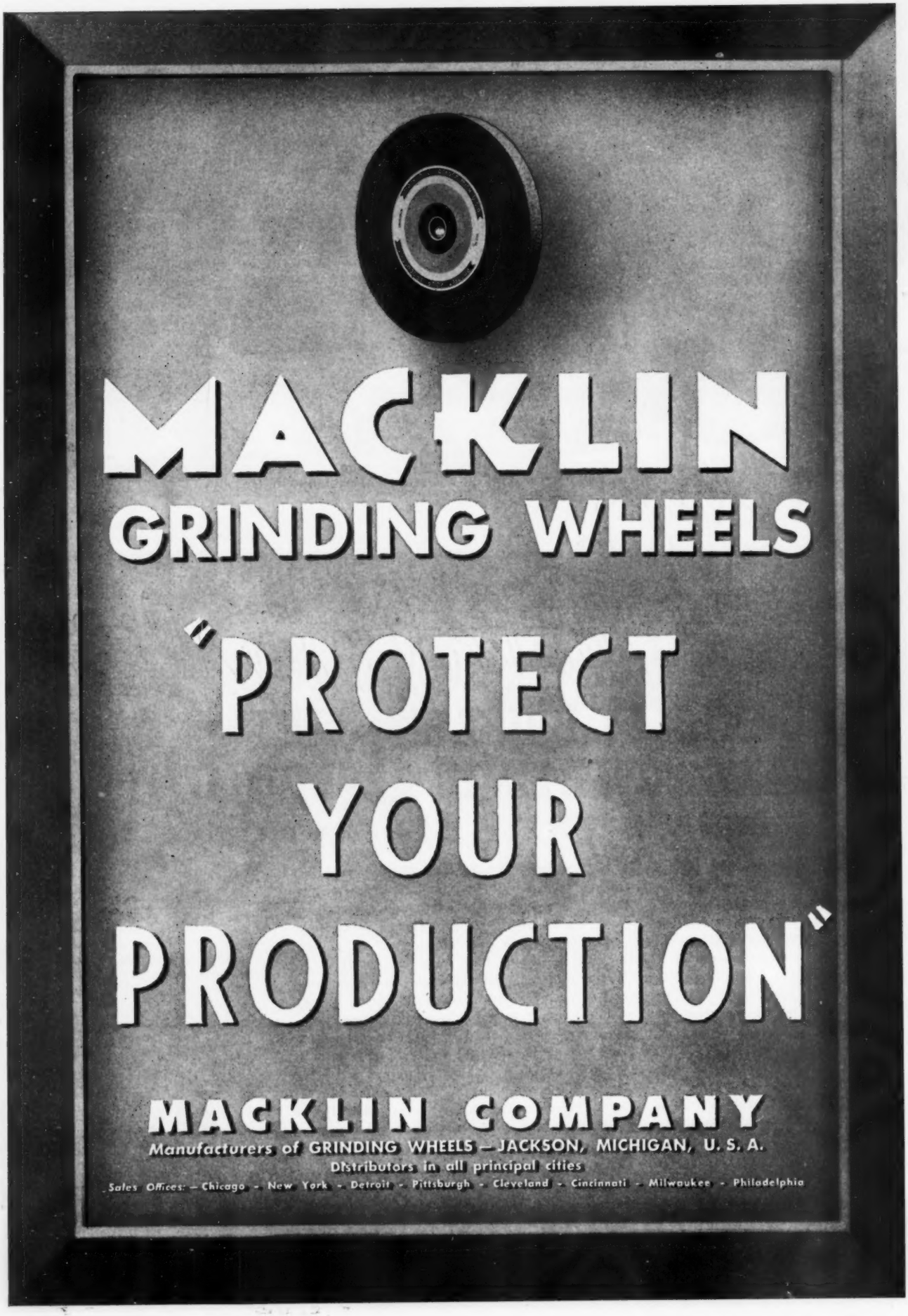
• THE METALMASTER BED is of semi-steel (50% to 60% steel, and 1% nickel) to provide a smooth wearing surface of uniform grain structure. Two V and two flat ways are planed and hand scraped for the entire length of the bed, with generous carriage and tailstock ways. Deep walls, connected by heavy crossgirths, closely spaced, prevent springing under the heaviest cuts. Bed is supported by heavy cabinet legs at both head and tail ends . . . on long beds, center legs (cabinet type) are added for additional support. Chip pans can be installed at any factory, or can be added at any time. Drip troughs cast with legs make this possible.

This advertisement is one of a series describing in detail the principal elements of the Bradford Machine Tool Co.'s new METALMASTER Geared Head Lathes. Write for complete story in one convenient folder.

Metalmaster Sizes:—12", 14" and 16" swing,—6' to 16' bed

THE BRADFORD MACHINE TOOL CO.
CINCINNATI, OHIO
MAKERS ALSO OF UNIT TYPE DRILLING & TAPPING EQUIPMENT

PRECISION TOOLS SINCE 1840


MACKLIN
GRINDING WHEELS
"PROTECT
YOUR
PRODUCTION"
MACKLIN COMPANY
Manufacturers of GRINDING WHEELS — JACKSON, MICHIGAN, U. S. A.
Distributors in all principal cities
Sales Offices: — Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia

Saved Hours

OF HAND-FINISHING TIME WITH GORTON ON THIS WAR JOB

A FEW GORTON CIRCULAR TABLES ARE AVAILABLE FOR IMMEDIATE DELIVERY—Precision built, for a lifetime of service. Simple, positive adjustments compensate for wear. Table surfaces are accurate within .0005". Work may be indexed to 5 minutes or less. Standard sizes: 10", 12", 15" diameter. For full details write for FREE Accessories Catalog 1317-D.

PRODUCING TOUGH ALLOY STEEL DIES within maintained limits of ±.001" or closer, makes possible a saving of hours of hand finishing. This job and many others like it being turned out by a midwest die and mold manufacturer is a typical example of what can be accomplished with the combination of a Gorton Super-Speed Mill and a Gorton Circular Table, accurate within .0005".

Photo above shows how the die is simply mounted on the circular table. Large micrometer dials on the Gorton Miller and the sensitive "feel" of the machine permit the operator to hold close tolerances with hand feed. Utilizing the Gorton wide range of spindle speeds, these dies are completely machined in 30 hours. Precision milling in this manner produces a finish so smooth that hand finishing is reduced to a minimum.

Gorton Engineers, specializing in Vertical High-Speed Milling, will be glad to make recommendations on your work—without obligation.

HOW TO REPRODUCE ORIGINAL DIES *without Skilled Help*

NOTE—To owners of Gorton Super-Speed Vertical Milling Machines built since 1935—if you have MULTIPLE DIES to REPRODUCE from an original, order a GORTON Duplicating Tracer Head and Duplicating Table to quickly convert your Miller into a double-purpose machine, capable of Duplicating parts and sinking dies, as well as Milling.

This equipment will effect an average time-saving of 50 per cent with *an unskilled man or woman* operator.

SUPER-SPEED MILLING DATA

MACHINE—Gorton Super-Speed Vertical Mill.

PART—Alloy Steel Die.

CUTTERS—Gorton Single and Double Flute Cutters.

DIMENSIONS—1½" Deep to Parting Line.

HOLDING—Simple "T" Slot Clamps.

FEED—Hand.

SPEED—950 RPM.

ACCURACY—Limits held ±.001.

FLOOR-TO-FLOOR TIME—30 hours on Mill to very smooth finish.

WRITE FOR FREE CATALOG 1400-B

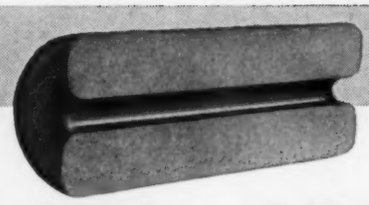
giving details on Gorton Super-Speed Vertical Milling Machines.

GEORGE GORTON MACHINE CO.

1315 RACINE STREET, RACINE, WISCONSIN, U.S.A.

SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

SUNNEN *Precision* HONING MACHINE



Average Number of Pieces from Header Die Increased from 25,000 to 225,000!

That's MORE Production

Imagine — an increase of nearly 1000% in the number of pieces from a die after it had been Sunnen honed! That's the kind of increased production Donald Nelson is calling for—the kind that will help us speed the day of victory.

Of course, we can't assure every manufacturer such amazing results — but increases in production of 100% to 500% are being reported almost daily.

If you are reaming or grinding internal cylindrical surfaces from .185" to 2.400" in diameter, it will pay you to get full information on this practical, inexpensive, accurate equipment at once. Consider the value of these outstanding features:

1. Does not require skilled labor.
2. Relieves big internal grinders for other jobs.
3. Can be set up and work located in one minute.
4. Accuracy within "one-tenth" guaranteed.
5. Produces super-smooth finish.
6. Size adjustment can be made with machine in motion.
7. Corrects errors of out-of-roundness or taper caused by previous operations.

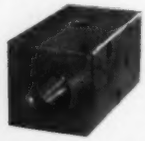
Write for
FREE BULLETIN

— giving complete information and showing many examples of use. Or, if you prefer, we'll have a Sales Engineer call and demonstrate this equipment in your plant on your job.

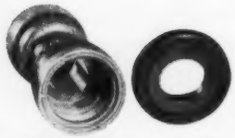
SUNNEN PRODUCTS COMPANY
7941 Manchester Avenue St. Louis, Missouri
Canadian Factory — Chatham, Ont.

SUNNEN

Aluminum Aircraft Link "produces high finish without bell-mouthing."



Saved time in producing a smooth, accurate finish on this bronze remote control valve body.

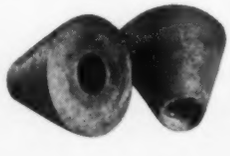


Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

Aircraft Valve Tappet Roller. 4-Micro finish.

"Produced an extremely accurate and glass-like finish."

Airplane Engine Parts accurately honed to a super-smooth finish.



Cones for Wheel Balancing Machine "Accurately align hones two interrupted surfaces."

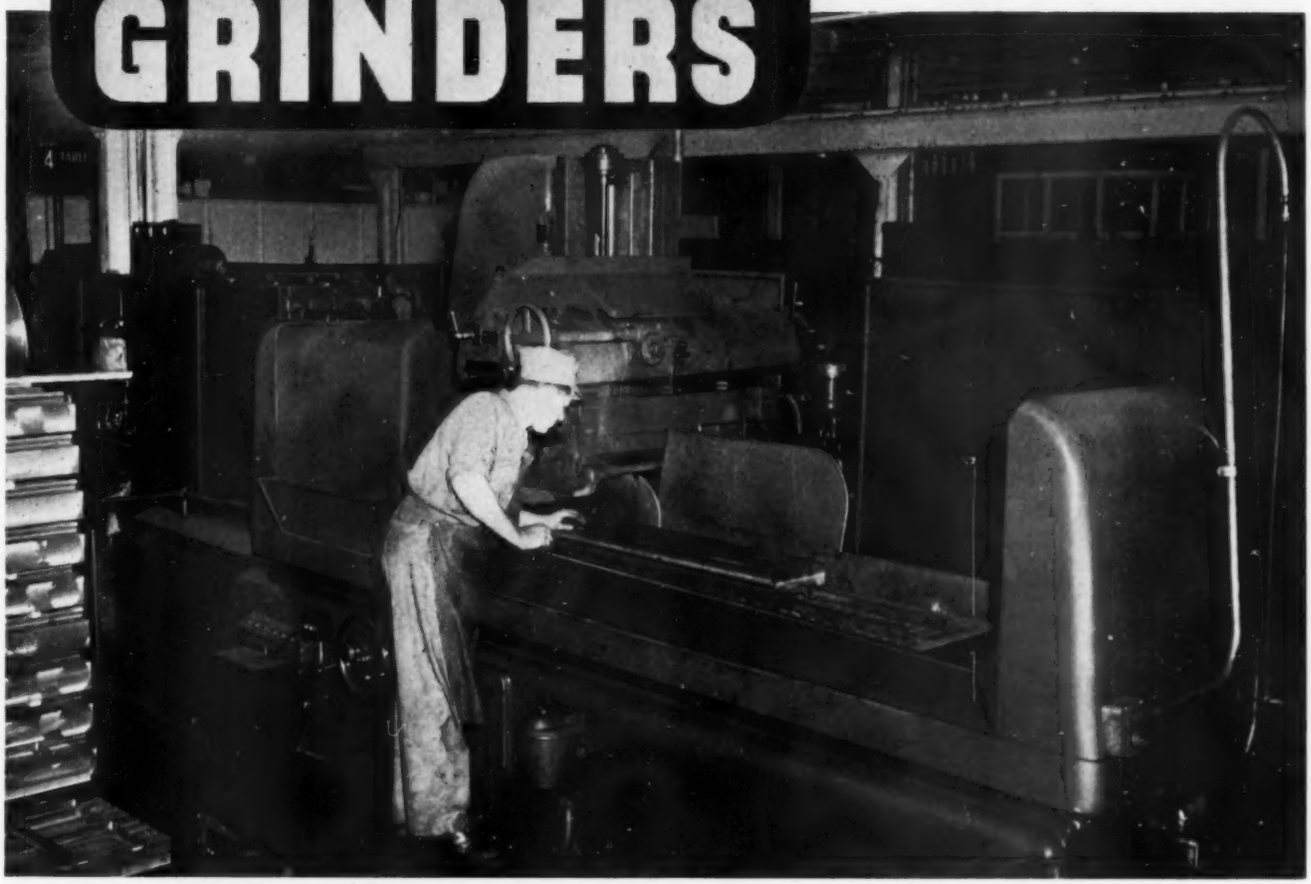
Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Drill Jig Bushing "Increases sales appeal of product."

Drawing and Blanking Die "Saves time in producing smooth base metal finish."

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

THOMPSON GRINDERS



combine speed and accuracy to meet War demands

Speed—Speed—Speed is the urgent cry heard from all quarters today—but speed alone isn't enough—accuracy to tolerances here-to-fore considered impractical is now a "must" and is being maintained on Thompson Grinders.

Shown here is a Type C Thompson Grinder finish grinding the tops of milling machine tables for a prominent mid-west machine tool builder.

The hydraulic power unit, common to all Thompson Grinders, the hydraulic rapid transverse and exceptionally sturdy bed and column construction not only assures freedom from vibration but permit feeds and speeds impractical by other methods.

Thus Thompson with its long experience in precision grinding now offers unusual speed with definite tolerances for work turned out on a high production basis.

For complete details

WRITE

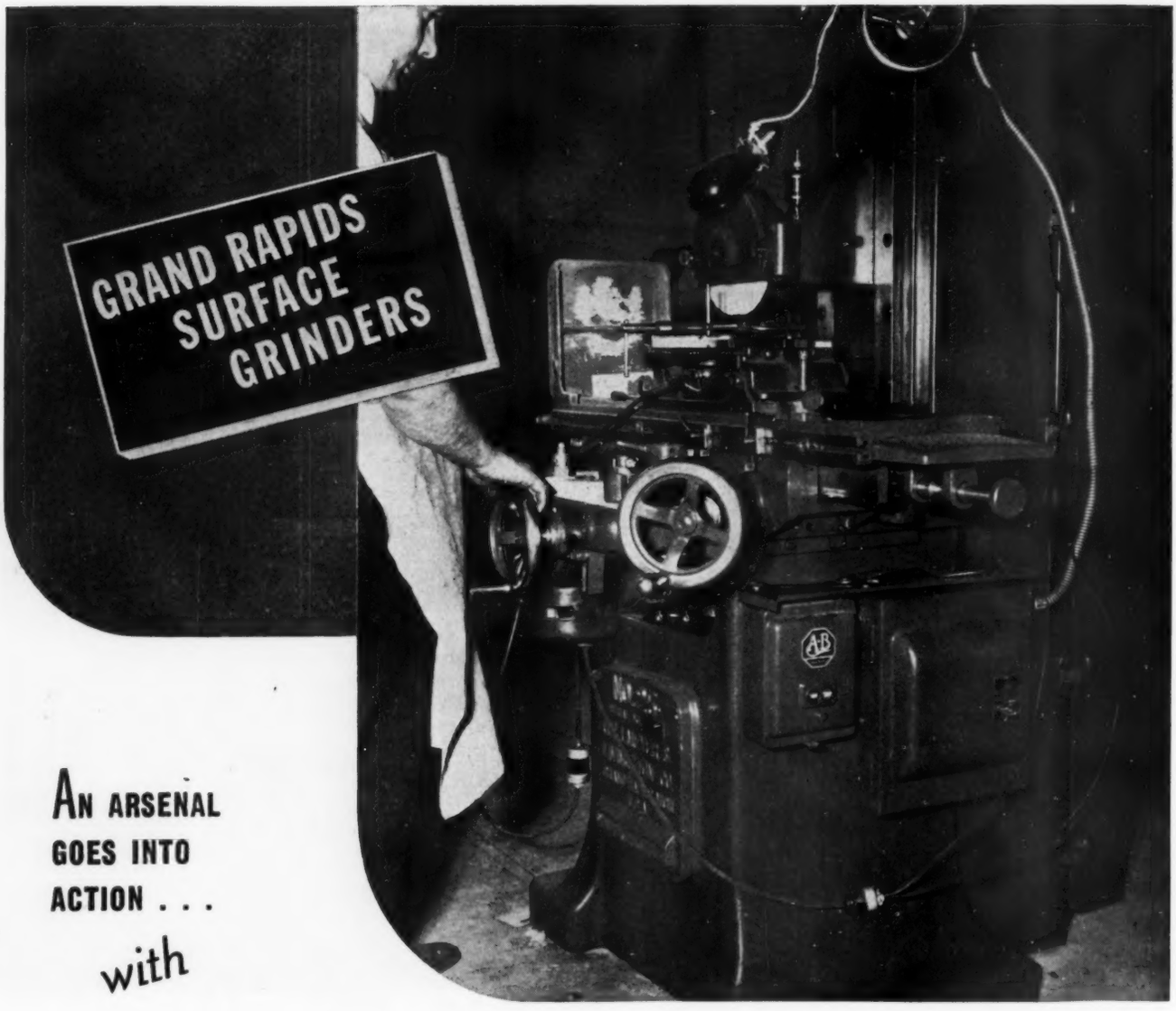
for full descriptive bulletin

●

THE THOMPSON GRINDER CO.

Completely Covering all Normal Ranges of Surface Grinding Requirements

SPRINGFIELD, OHIO, U. S. A.



AN ARSENAL GOES INTO ACTION . . . with

MODERN SURFACE GRINDERS • • •

One of these modern machines is shown in action here on a tool steel bar. This machine is designed primarily for tool room work and is the fastest unit of its size and type in the Grand Rapids line.

The sturdiness, ruggedness and flexibility of these machines makes them especially adaptable to tool room work. They can be depended on for high accuracy in long hard service.

Standard features include hydraulic longitudinal and transverse table movements. A swivel type wheel guard facilitates use for form tool grinding. Cross feed hand wheel is graduated for operator's convenience.

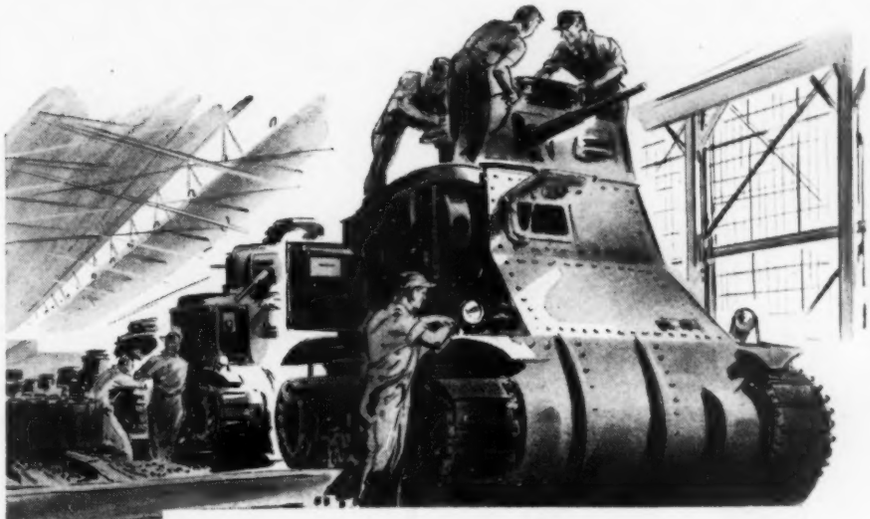
Grand Rapids Surface Grinders are offered in sizes and types for all modern requirements. They are the result of more than 35 years specialized experience in the design and building of high quality, precision grinding equipment.

Ask our engineers to show you how, by going into action with Grand Rapids Surface Grinders, you can cut costs and improve the quality of your work.

For Additional Information Write for Catalog GL-100.

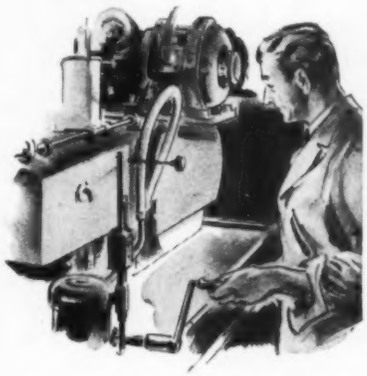
GALLMEYER & LIVINGSTON CO.
330 STRAIGHT AVE.
GRAND RAPIDS, MICH.

The wheel that cuts tank armor like a sharp knife slices bread!



When steel men made tank armor that could withstand anti-tank fire, they put our army one up on the battlefield. But they posed a new problem in tank construction. Precision cutting of the armor plate is necessary at many places to insure contact for welding. But because of its toughness, ordinary mechanical cutting methods wouldn't do. What was the answer? With Carborundum Brand Cutting-Off Wheels, the 1-1/8" armor plate is now sliced like you'd slice a loaf of bread. And so accurately that mating parts fit perfectly.

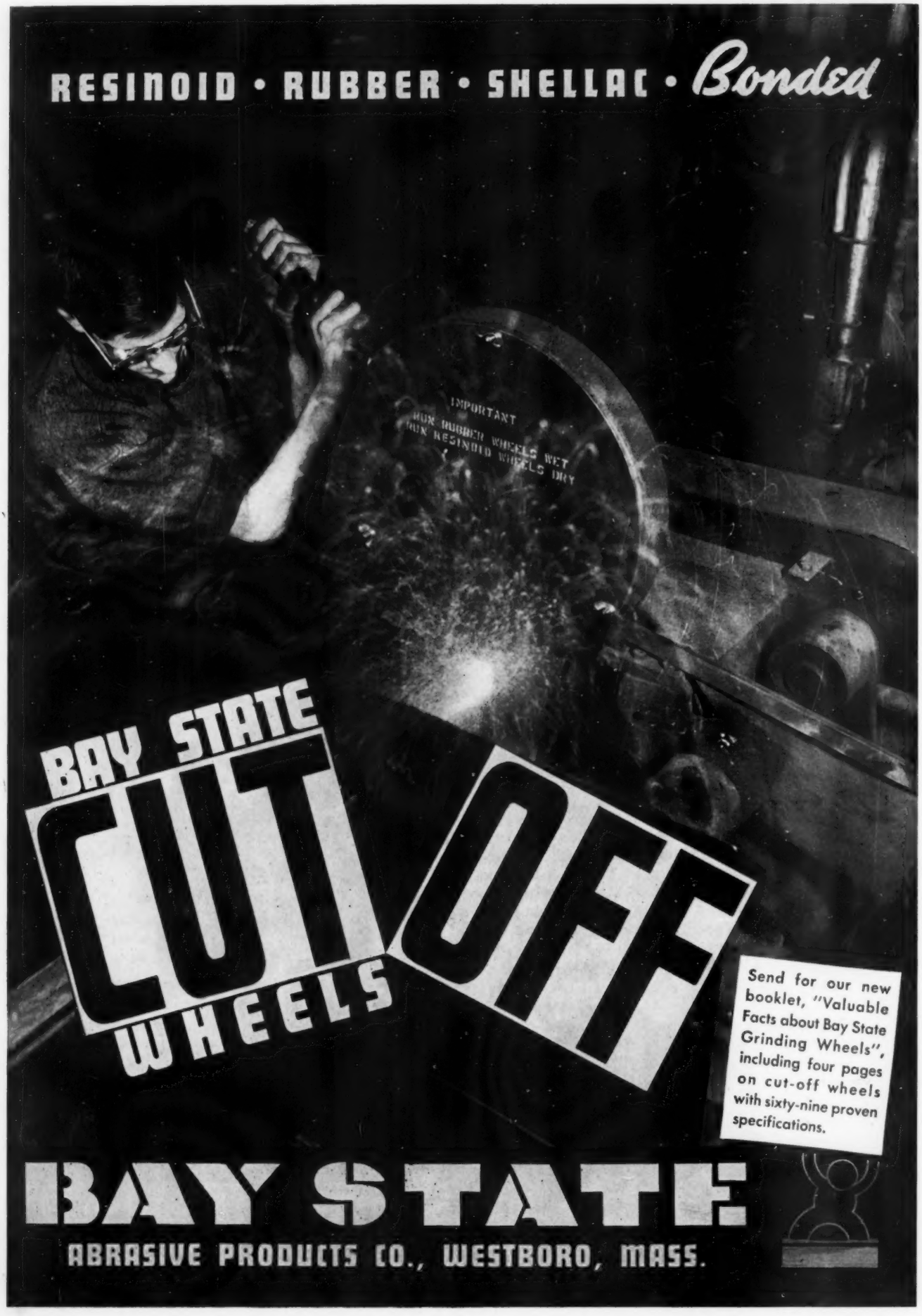
These abrasive wheels have revolutionized cutting-off methods. Often of extreme thinness, they even perform such delicate operations as slotting the points of fountain pens! Today Carborundum-made Cutting-Off Wheels are used to cut plastics, glass, brick, tile, steel and non-ferrous metals in plate and bar stock ...faster, more safely, and more economically. In most cases further finishing is unnecessary.



This is not the only "short cut" in which Carborundum has pioneered. Our research, plant facilities, and sales engineering have helped manufacturers reduce costs and speed production in many ways. Perhaps they can do as much for you. The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM
REG. U.S. PAT. OFF.
ABRASIVE PRODUCTS

Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company

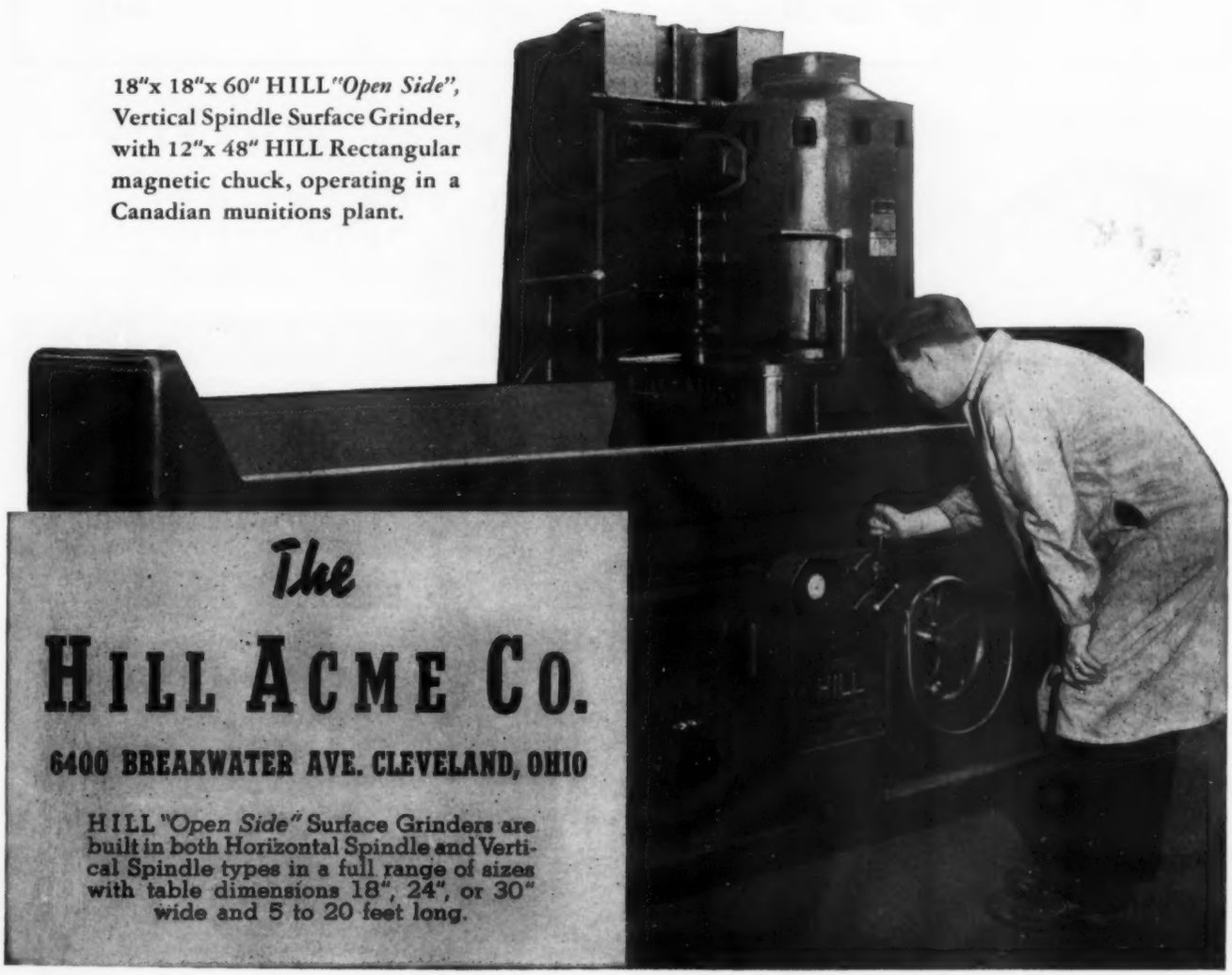

RESINOID • RUBBER • SHELLAC • Bonded
IMPORTANT
RUN RUBBER WHEELS WET
RUN RESINOID WHEELS DRY
BAY STATE
CUT OFF
WHEELS
Send for our new booklet, "Valuable Facts about Bay State Grinding Wheels", including four pages on cut-off wheels with sixty-nine proven specifications.
BAY STATE
ABRASIVE PRODUCTS CO., WESTBORO, MASS.

LET'S FINISH THE JOB THIS TIME!

A HILL HYDRAULIC SURFACE GRINDER WILL HELP

★ Concentration of Man Power plus Machine Efficiency will win the War. Undoubtedly your production operations can be accelerated by using HILL *"Open Side"* Hydraulic Surface Grinders.... HILL Heavy Duty Grinders are ideal for production operations — incorporating the two vital characteristics of speed and accuracy. They are built to *FINISH THE JOB!*... Our experienced staff will assist you in selecting the correct type of HILL *"Open Side"* Hydraulic Surface Grinder best suited to *your* increased production needs.

18"x 18"x 60" HILL *"Open Side"*, Vertical Spindle Surface Grinder, with 12"x 48" HILL Rectangular magnetic chuck, operating in a Canadian munitions plant.



The

HILL ACME CO.

6400 BREAKWATER AVE. CLEVELAND, OHIO

HILL *"Open Side"* Surface Grinders are built in both Horizontal Spindle and Vertical Spindle types in a full range of sizes with table dimensions 18", 24", or 30" wide and 5 to 20 feet long.

VITRIFIED

Keep production on its toes by standardizing on . . .
VITRIFIED GRINDING WHEELS

The Vitrified complete line includes also Silicate, Shellac and Resinoid bonded wheels for conditions requiring high finish, elasticity and heat resistance.

Vitrified Wheels

Grinding equipment — for tools or for production requirements—can be brought to higher degrees of precision and speed by standardization of Grinding Wheels.

These objectives can easily be realized through the use of Vitrified Wheels for every grinding operation, because Vitrified offers a complete line of sizes, shapes and types, processed especially for the work to be handled.

. . . Cast Iron, Bronze, etc., can be ground at low cost and efficiency on Vitrified Carborite Wheels. . . . For accurate, fast grinding of steel on a production basis, Vitrified Borite Grinding Wheels increase output and reduce costs.

. . . Also, make Silicate, Shellac and Resinoid Bonded Wheels.

Ask a Vitrified representative to show you how economically you can modernize your grinding operations by standardizing on Vitrified Wheels.

VITRIFIED WHEEL CO.
WESTFIELD MASS.

THE REED POLICY

of PLANT EXPANSION
INCREASED PRODUCTION
SIMPLIFICATION OF MODELS

IS AIDING US TO DELIVER MICROMETERS

to plants that can furnish preference ratings and to mechanics who can fill in our simple form, proving that they are working for defense.

In order to meet the tremendous demand among thousands of mechanics for micrometers, the REED factory is temporarily devoting its entire production to the following four models.

ONE INCH MICROMETERS

No. 801 plain	List $ 6.25
No. 901 plain with 1/10,000" vernier	List $10.25

TWO INCH MICROMETERS

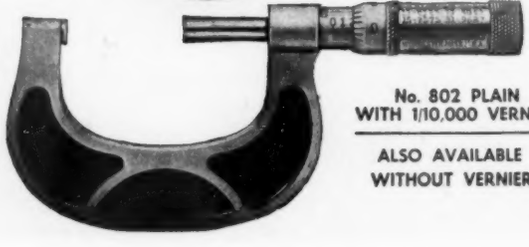
No. 802 plain	List $ 7.00
No. 802 plain with 1/10,000" vernier	List $ 8.75

SEND IN YOUR ORDER OR WRITE FOR FOLDER

GEO. SCHERR CO., Inc.
124 Lafayette St. New York, N. Y.

No. 801 PLAIN

No. 901 PLAIN
WITH 1/10,000 VERNIER



No. 802 PLAIN
WITH 1/10,000 VERNIER

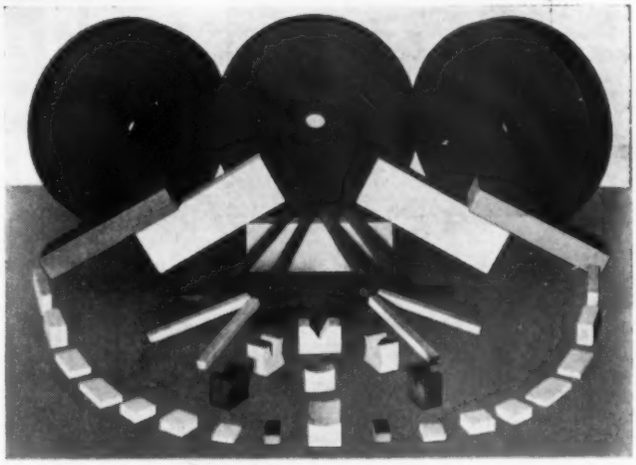
ALSO AVAILABLE
WITHOUT VERNIER

The proven dependability of parachutes makes this man confident his will open. . . . And so it is with MID-WEST abrasives.

Engineers have absolute confidence in Mid-West products because Mid-West produces the world's MOST DEPENDABLE abrasives. Mid-West honing stones, grinding wheels and coated abrasives hold that confidence because they are CONSISTENTLY DEPENDABLE.

MID-WEST honing stones are second to none in the world when it comes to cutting speed, smoothness of finish and dimensional accuracy.

MID-WEST stones are *precision manufactured* for *precision manufacturing*. Being of uniform hardness and uniform grain structure they cut uniformly and wear uniformly. Furthermore, they have an effective lifespan far exceeding that of average abrasives. Our engineers are eager to prove these claims by helping you solve your honing problems. Samples shipped from stock immediately.



MID-WEST ABRASIVE COMPANY

2189 BEAUFAIT *Manufacturers of grinding wheels, sandpaper and emery cloth* DETROIT, MICHIGAN

MID-WEST ABRASIVES

HASKINS **Flexible Shaft Equipment**

MORE VERSATILE MACHINES for MORE PROFITABLE WORK

THERE are 30 different kinds of Haskins Flexible Shaft Equipment for every kind of work. There's the right power and the right drive for every job. There's the right mounting for every shop requirement. Any *one* kind of Haskins Equipment will do *many* kinds of work. On heavy or light duty grinding, sanding, polishing, rotary filing or wire brushing, Haskins will give you lower costs per man and machine hour. For full details and many applications, write for Catalog 45. R. G. Haskins Company, 2760 W. Flournoy Street, Chicago.

HASKINS *Versatile* FLEXIBLE SHAFT EQUIPMENT

MILLING, GRINDING, Surfacing Operations NOW DONE *5 to 10 Times Faster!*

Note to PRODUCTION Men

The call is for MORE . . . and then some! You've been elected to do the job. So, any new methods that promise to do better and faster work deserve your immediate investigation. "Belt Machining" is just such a new method.

With the NEW

PORTER-CABLE Wet-Dry BELT GRINDER

Here, in this new Porter-Cable G-8 Wet-Dry Belt Grinder, may be the answer to many of your most difficult production problems. For it's more than "just another machine." It represents a new high-speed machining process — *precision wet - belt grinding.* And the things it can do seem almost a production miracle.

The Precision Work of a Major Machine at the Low Investment of a Belt Grinder!

Today, in hundreds of nationally-famous plants, Porter - Cable G-8's are taking over many operations usually done on millers, planers, surface grinders, shapers — and doing those jobs 5 to 10 times faster to tolerances as close as .0005". They're handling all types of materials—hard and soft metals, stainless steel, alloys, plastics, glass, hard rubber—with no heating, fracturing, discoloring or dust. They're stepping up production, lowering costs, smoothing the flow of work—all at a fraction of the equipment-cost of larger major machines!

See This New Machining Method DEMONSTRATED!

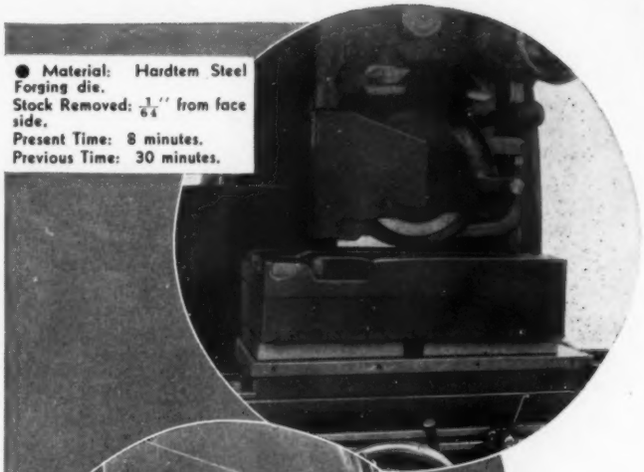
Call your local Porter-Cable man (name in phone book) or write us direct regarding arrangements for a demonstration of the G-8 *on your own work!* No obligation.

FREE — third edition of "Wet-Dry Belt Grinding in the Spotlight". Interesting, timely, helpful. Contains many actual production applications. Send for your free copy today.

PORTER - CABLE MACHINE CO. 1725-5 N. Salina St., Syracuse, N. Y.

Representatives in All Principal Cities

'TIME OUT' FOR DIE RECONDITIONING HELD TO A MINIMUM

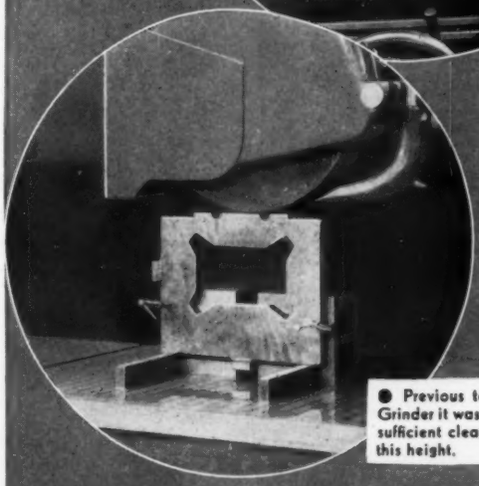


● Material: Hardtem Steel Forging die.
Stock Removed: $\frac{1}{64}$'' from face side.
Present Time: 8 minutes.
Previous Time: 30 minutes.

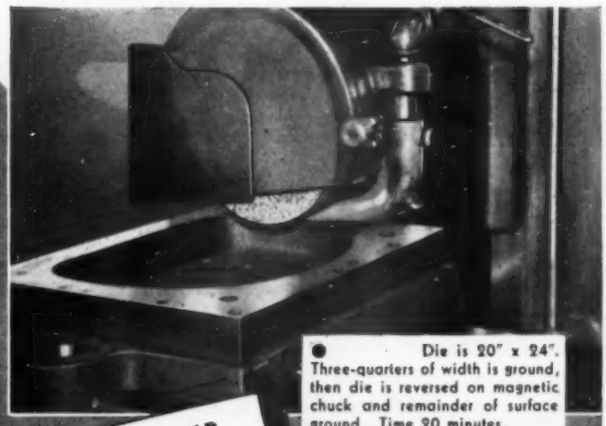
A GREAT variety of die work can be speedily and easily handled on the Mattison Surface Grinder. Its large capacity, ability to hog off stock and high power, keeps the 'time out' periods to a minimum.

A few examples of die jobs ground on the Mattison at a considerable saving in time, are shown on this page. Die shown in the lower left hand corner was ground with leader pins in place at ⅓ of former time. Wheel and spindle clearance of Mattison Grinder is sufficient to handle this type of work with ease, eliminating time required for disassembly and alignment when leader pins are removed.

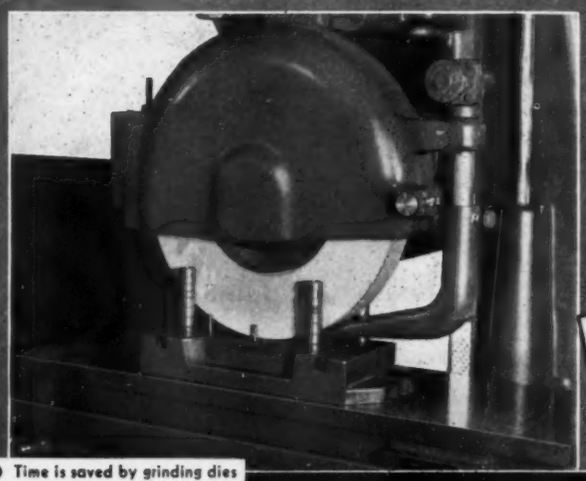
For further data regarding use of Mattison Grinders for reconditioning dies, ask us to send you set-up sheets on this subject.



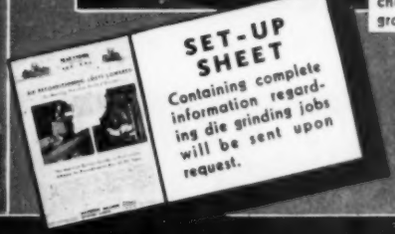
● Previous to obtaining Mattison Grinder it was not possible to obtain sufficient clearance to grind dies of this height.



● Die is 20" x 24". Three-quarters of width is ground, then die is reversed on magnetic chuck and remainder of surface ground. Time 20 minutes.



● Time is saved by grinding dies with leader pins in place.



MATTISON MACHINE WORKS, ROCKFORD, ILL., U. S. A.

Prompt Shipment on
WALKER-TURNER RADIALS!

Four to six weeks shipment for a WALKER-TURNER RADIAL DRILL! Seems impossible in these crowded days, but efficient large scale production methods enable us to make shipment within this period, on the average, to companies engaged in war production. Fast, accurate, rugged, these up-to-date machine tools fill a long-felt need for a radial drill for light drilling, tapping, routing and profiling. Unobstructed, stream-lined simplicity...no complication of levers and dials ...no excess weight...less power consumption...less operating effort. Ideal for new, unskilled help, as well as for old-timers. Women operators, especially, find it easy to put in a productive day on these Radials without fatigue.

WALKER-TURNER CO., INC.
4440 Berckman Street **Plainfield, N. J.**

Specifications

JACOBS CHUCK: ½" capacity or No. 1 Morse Taper.

SPINDLE SPEEDS: eight — from 160 to 8200 r.p.m. with 1740 r.p.m. motor. Speeds proportionately lower with 1140 r.p.m. motor.

OVERALL DIMENSIONS: height 72", width 31", depth 58".

SHIPPING WEIGHT: 450 lbs.

BEARINGS: sliding ram carried on 8 precision ball bearings. Ball bearing swivel for free horizontal movement.

SIX-SPLINE SPINDLE: four precision ball bearings, with pulley mounted between two bearings to eliminate belt strain.

CAPACITY: drills to center of 62" circle. Distance nose of chuck to table 13½". Spindle traverse 3¾". Drill head may be tilted to 45° right or left.

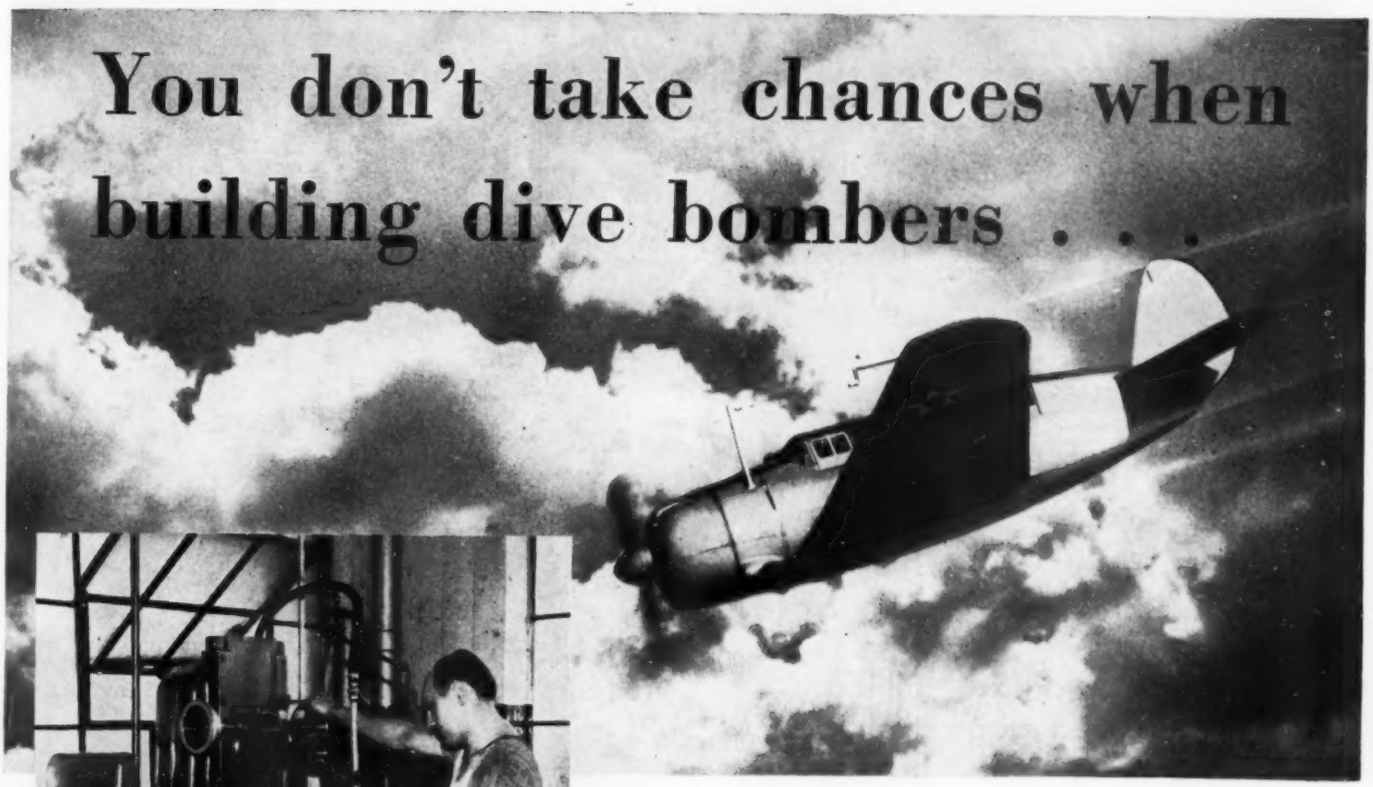
PRICE: $352.50 F.O.B. Plainfield (Motor Extra)

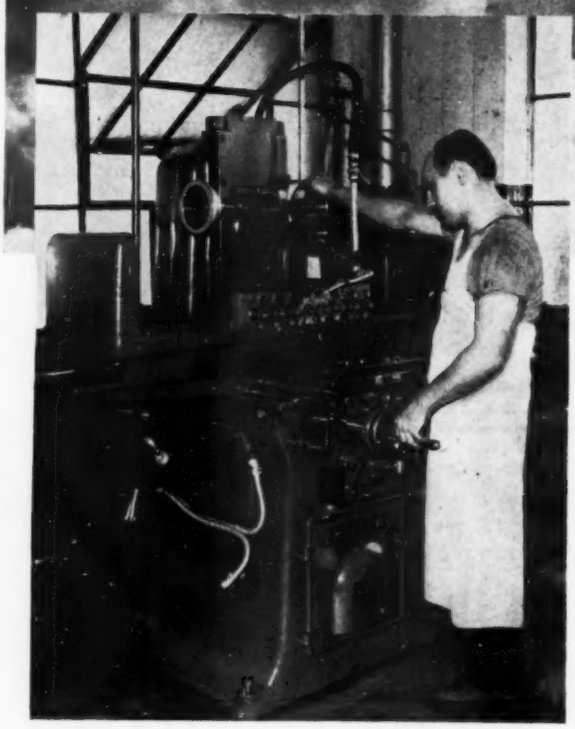
walker-Turner COMPANY, INC. PLAINFIELD, N.J. U.S.A.

WALKER-TURNER MACHINE TOOLS
FOR METAL, WOOD AND PLASTICS

DRILL PRESSES · BAND SAWS · BENCH SAWS · TILTING ARBOR SAWS · LATHES
JIG SAWS · RADIAL SAWS · RADIAL DRILLS · BELT AND DISC SURFACERS · JOINTERS
SPINDLE SHAPERS · GRINDERS · FLEXIBLE SHAFT MACHINES · CUSTOM BUILT MOTORS

You don't take chances when building dive bombers . . .





THAT'S WHY YOU'LL FIND *ABRASIVE SURFACE GRINDERS* IN AMERICA'S AIRCRAFT ENGINE SHOPS

"Give us precision accuracy at high speed, we can't take chances" is the cry from the production line!

At the Wright Aeronautical engine plant, where the 1700 HP Cyclone engine that powers this new Curtiss XSB2C-1 dive bomber is built, as at other aircraft engine plants, Abrasive Surface Grinders are busy on the production line. Illustration shows a No. 3B Abrasive Grinder at the Wright plant grinding the slot in the valve rocker arms to close limits of accuracy. Other typical aircraft engine jobs include: grinding of connecting rod ends; master connecting rods, and grinding of flat surfaces on crankshafts.

At most plants, the burden falls on the No. 3B Grinder with its capacity for grinding work up to 24" x 8" x 12" high. Likewise, hundreds of No. 34 Vertical Spindle Grinders are in service and the smaller, No. 1½ machine (with an unusual capacity, 15" x 10" x 12" high), plays an important part in the tool room where short jobs on work of a variety of sizes are the rule.

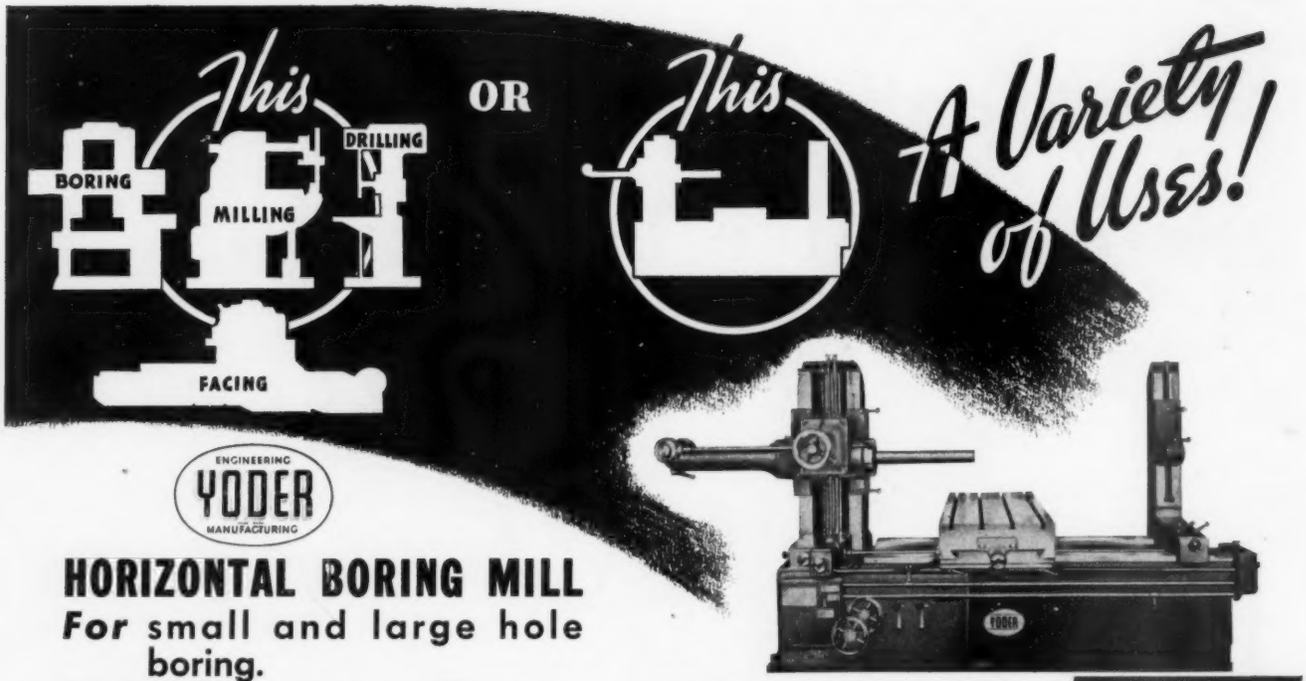
At our defense-enlarged plant, we don't take chances either—we know we must build into each Abrasive Grinder the "precision" the user expects from it.

Abrasive No. 34 Vertical Spindle Surface Grinder

excellent for small flat dies, washers, punches, spacers, chasers, parallel blocks, etc.

ABRASIVE MACHINE TOOL CO.

EAST PROVIDENCE . . . . . RHODE ISLAND



ENGINEERING YODER MANUFACTURING

HORIZONTAL BORING MILL

For small and large hole boring.
For end and face milling.
For slot and gear milling.
For drilling and tapping for location.
For face-finishing sides of parts.

We have a folder for you.
Write Now, RIGHT NOW!

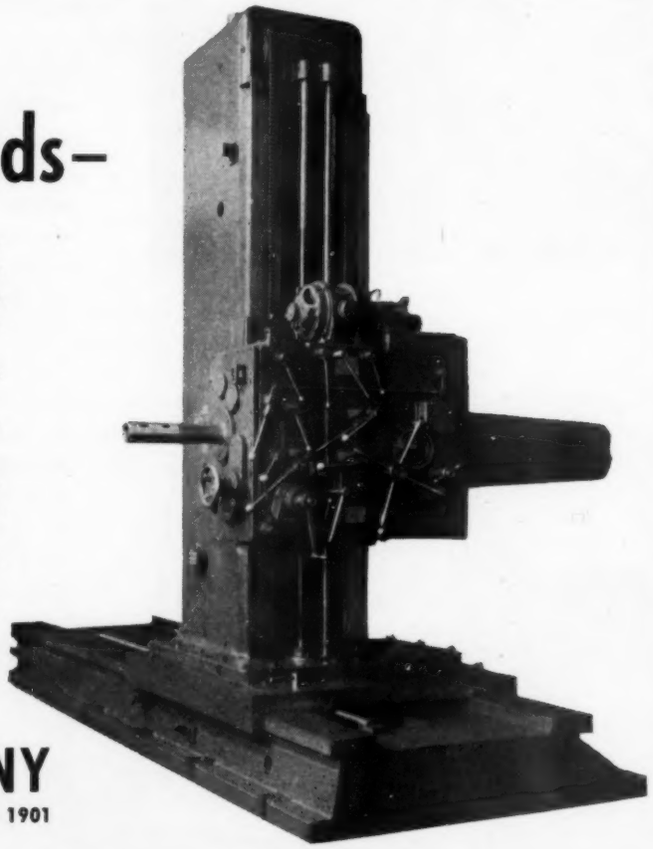
The ENGINEERING YODER MANUFACTURING **SALES COMPANY**
5500 WALWORTH AVE.
CLEVELAND, OHIO

To Meet War Production Demands–

This horizontal drilling and boring machine is only one example of what machine tool builders all over the United States are doing to help industry produce the equipment required by our armed forces.

The MR108 machine, as illustrated, includes the following:

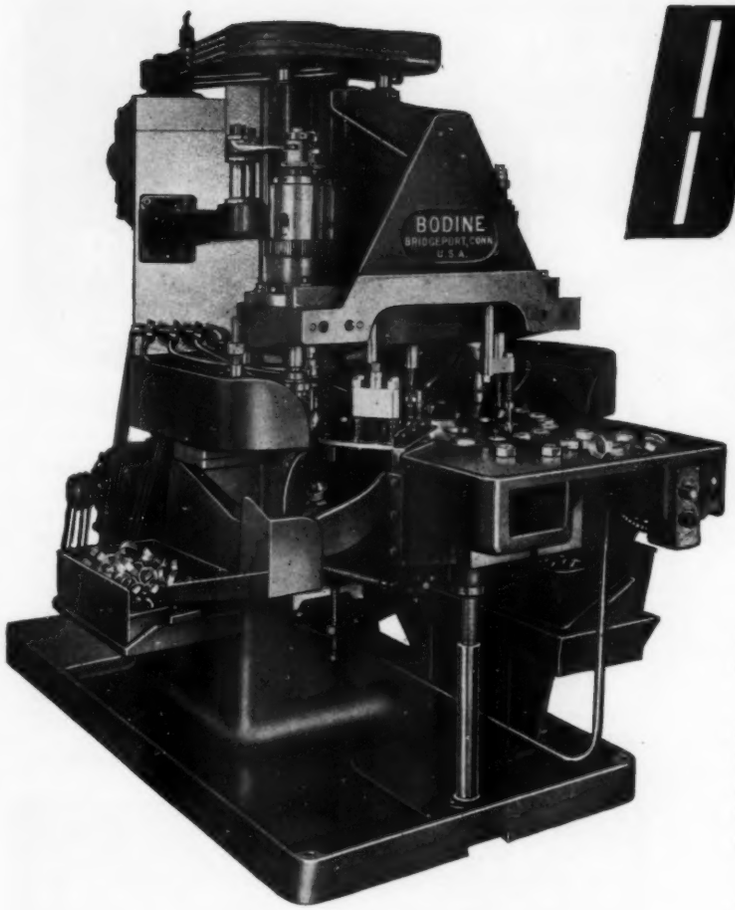
Boring bar .....4-inch diameter
Spindle rotational speeds ..... 24.
Power feed rates..... 12.
Horizontal travel of column on base.....12 feet.
Vertical travel of spindle on column.....6 feet, 6 inches.



★

MOLINE TOOL COMPANY

"Holehog" Moline, Illinois Established 1901



Bodine

MEETS THE HANDICAP OF *Semi-Skilled* LABOR .. GIVES WAR PLANTS HIGH PRODUCTION

One of the headaches of war production is the training of sufficient *skilled* machinists for three-shift operation.

With *Bodine* automatic Dial Type Multi-purpose machines, this handicap is at least partially overcome. Operation is completely protected by electrical interlocks, and every consideration has been given to building into the machines the most advanced elements of design which simplify and safeguard operation.

The Bodine 48-30 machine illustrated is equipped with two heavy duty drilling spindles and two heavy duty threading spindles to produce ¾" pipe union nuts.

The operator drops malleable iron or brass castings into the fixtures on the dial. As the dial is automatically indexed the nuts are first core drilled to produce two diameters and a shoulder, using an inserted tooth form cutter. In the working station the collapsible taps do the threading. The nuts are then automatically ejected into a receptacle where the coolant drains and is recovered back into the coolant system in the machine base.

This is but one of many multiple operation jobs performed by Bodine machines, automatically and at the high speeds required under war-time production.

Bodine does this..

- Builds 6 sizes of Automatic dial type machines and develops correct tooling set-ups to perform the operations you require.
- Provides extreme flexibility in the basic design to permit tooling for an exceptionally wide range of parts.
- Makes recommendations from your blue prints or sample parts to solve tough production problems.

THE **Bodine** CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

DRILLING, MILLING, TAPPING, SCREW INSERTING *Simultaneously*

The basic design includes a horizontal indexing table which holds the work, moving it in sequence to located stations where operations are performed by vertical, horizontal or inverted tools . . . (one position or all, simultaneously). Fully adjustable ball-bearing spindles are equipped with standard chucks or collets. Built for light or heavy duty. High speeds.

Woody Spencer says:
"The right pitch at the right time fanned the 3 heaviest sluggers in the American League."

For two straight innings before he retired in favor of Warnke—Carl Hubbell, opening the All Star Game in 1934—delivered a series of pitches from which none of the American League's best batters—Babe Ruth, Lou Gehrig and Heine Manush—could make a safe hit. An outstanding example of pitching skill, and another instance of the right play at the right time.

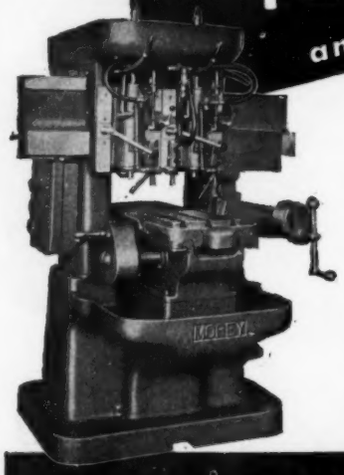
Your right play is to check into your tapping operations. Get the greatest possible number of tapped holes per tap used. Taps are at a premium—and we will gladly assist manufacturers to speed up their tapping wherever possible. Write us today . . . you will be under no obligation.

"The Right Tap at the Right Time"

The WOOD & SPENCER CO.
Cleveland, Ohio

Preloaded Precision Bearings for Spindles

MOREY 12M HIGH-SPEED VERTICAL PROFILER and MILLER



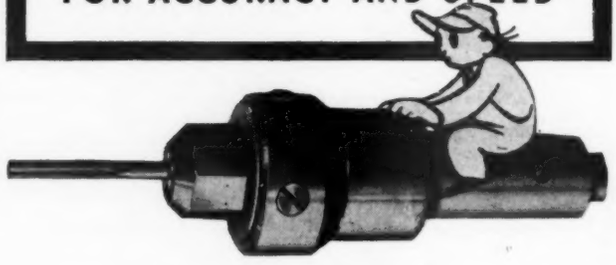
Two spindle or single spindle

Speed and more speed in the production of interchangeable parts requiring milling of any contour or outline is yours in the MOREY 12M. Provision for increased clearance between spindles and table.

Ask for Bulletin 680-A

MOREY MACHINERY CO., INC.
410 Broome Street New York, N. Y.

UNIVERSAL COLLET CHUCKS FOR ACCURACY AND SPEED



Universal *floating* collet chucks (above) are designed to operate horizontally in automatic screw machines and turret lathes. Adjustable spring pressure in 4 directions prevents dogtail motion and marred holes.

Universal *standard* collet chucks have ground threads, ample room for tool feed out and are ideal for holding end mills, keyway cutters, drills, etc. Nut fluted for Spanner wrench. Universal collet chucks grip as strong as solid steel itself. Write today for facts and prices.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH • MICHIGAN

Boring Time Cut in Half

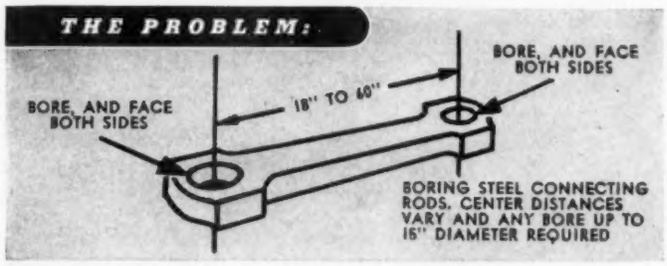
on Diesel Engine Connecting Rods

Simple Special Machine Doubles Production in Less than Half of Previous Floor Space . . . . . .

The two main bores of these Diesel engine connecting rods were formerly machined in two hours floor to floor. With this machine the time has been reduced to less than one hour per rod. Since the rods varied in size, a special machine had to contain adjustments for various center distances and bore sizes.

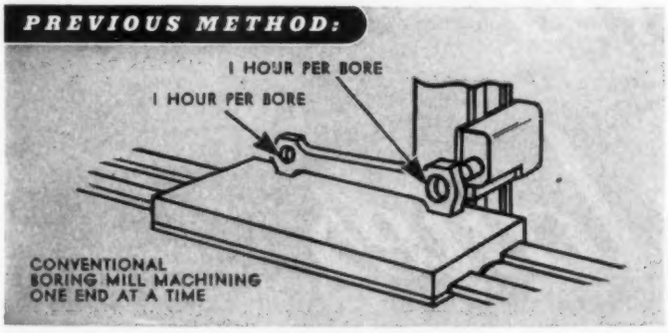
This is an excellent example of how production can be doubled without faster cutting, and without twice as many machines. Here's the story in brief:

THE PROBLEM:


BORE, AND FACE BOTH SIDES
18" TO 60"
BORE, AND FACE BOTH SIDES
BORING STEEL CONNECTING RODS. CENTER DISTANCES VARY AND ANY BORE UP TO 15" DIAMETER REQUIRED

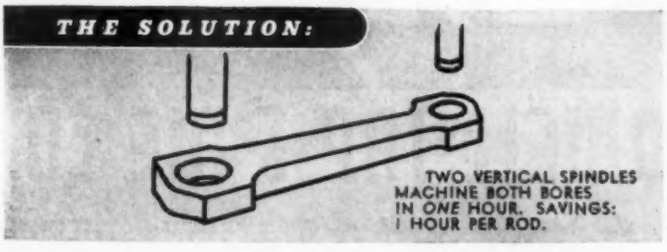
The rods are drop-forged high-carbon steel — center distances vary from 18" to 60". Two boring cuts, and facing of both sides is required on each end — stock to be removed varies up to ¾" on the side.

PREVIOUS METHOD:

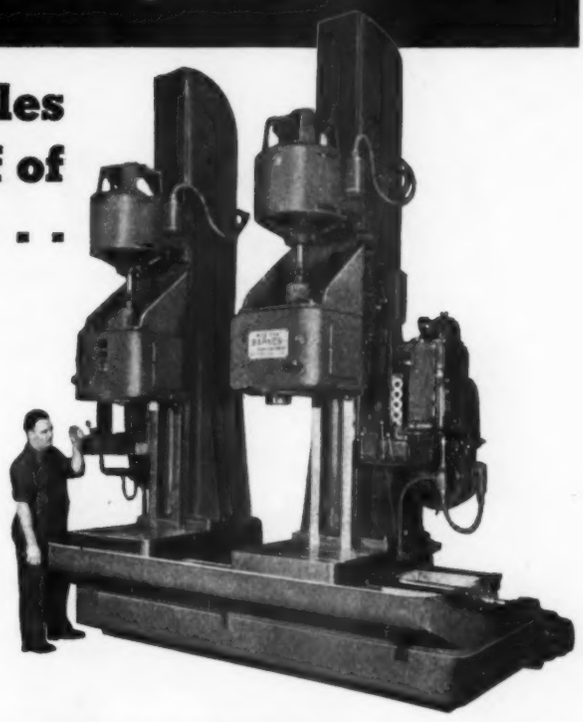


In using a conventional boring mill, only one hole could be bored at a time. After boring and facing one, additional time was lost in indexing table and gauging second bore. The production rate of two hours, on a rod of 36" center distance, was achieved only through proper tooling and fixture set-up on the boring mill. The bore sizes are 8" and 5½".

THE SOLUTION:



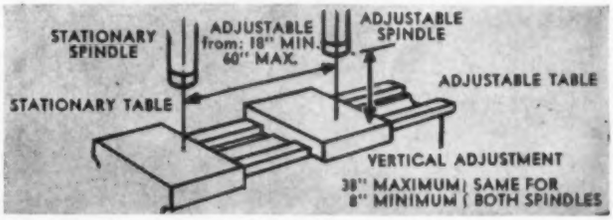
By providing a simple two spindle vertical machine, both rod bores can be machined simultaneously. The vertical position of spindles facilitates chip removal, while adjustment to one spindle accommodates rods of various lengths.



THE MACHINE

Sufficient adjustment is provided in this machine to accommodate various sizes of connecting rods. Each boring head is actuated individually by hydraulic feed and traverse units mounted on the column.

ADJUSTMENTS provided are shown below. Two tables mounted on the same bed are utilized. The left-hand head, column, and table are stationary. The right-hand unit is arranged for lateral adjustment.



More Production and Tooling Ideas FREE

Not a catalog, but a set of eight bulletins describing a better way to get better machines. Each bulletin traces a machining problem from the original study of the part to the final machine design. Each may suggest a more productive tooling set-up that you can use today—valuable file information for tomorrow. Write for bulletins: A. M. 3P

W. F. & JOHN BARNES
ROCKFORD ILLINOIS

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SUPERLATIVE THREADING

Threadwell

TAPS HELP BUILD BETTER ~~

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THREADWELL TAP & DIE CO.
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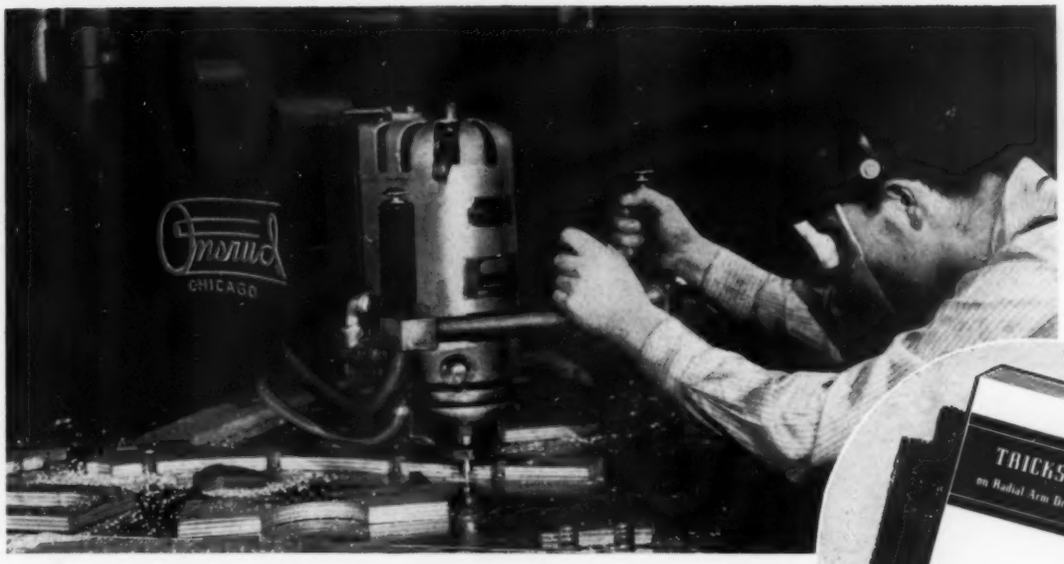


You've Heard of High Speed Radial Arm Production!

Radial arm drilling and routing—the method whereby stacked flat sheets are drilled and shaped to produce finished parts accurately at high production speed—is now clearly outlined and described in a 53 page, fully illustrated manual. Write for your free copy.

Any manufacturer or shop whose work involves production drilling or shaping of parts cut from flat or corrugated sheets should get the facts on Onsrud Radial Arm Drills and Routers. These machine tools permit a technique that is employed today almost 100% in the aircraft industry. Materials machined include the machinable nonferrous metals and their alloys, plastics, wood, and composition. This new Onsrud manual gives full details.

"Tricks and Tips on Radial Arm Drilling and Routing" is a textbook on this new machining technique, of practical use to operators, shop superintendents, maintenance men, and template and pattern makers.

Onsrud Machine Works, Inc.
3921 Palmer Street • Chicago, Illinois • U. S. A.
Sales Offices in all Principal Cities

Here's the Manual Explaining This New Method in Detail

THESE ARE A FEW OF THE TOPICS COVERED

The machining principle
Operating the machines
Tips on getting the most from the machines
Drills and router bits . . . and their uses
How to make drill templates and router patterns
How a job is handled from start to finish
Work set-ups for easier, faster production
Maintenance
How to work corrugated sheets

If you want to know more about these machines . . . write for the manual and tell us the kind of work you are doing. Those companies now using radial arm drills and routers are invited to write for copies for all employees engaged in this work.

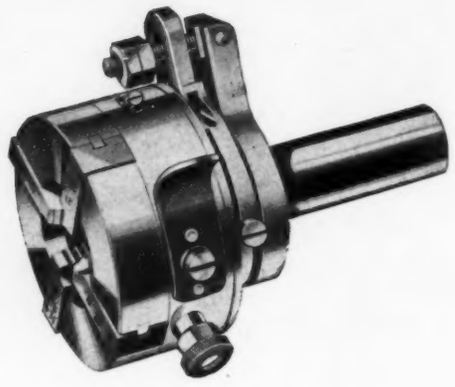
Onsrud

AIR TURBINE and HIGH CYCLE TOOLS and MACHINES
ROUTING • DRILLING • SHAPING • GRINDING • MILLING

STYLE DS
GEOMETRIC SELF-OPENING DIE HEAD

A Precision Tool for Accurate . . . Economical Screw Threading

Intended for use primarily on Brown & Sharpe Automatic Screw Machines. Can be used on other automatics where the Die Head does not rotate, also on light hand screw machines. (Made in six sizes in both automatic and hand types covering a range of 1/16" to 1¾" diameters inclusive.)



• Unusually Sensitive—Adjustable Lever Trip insures more sensitive tripping action which gives accurate threads at high rates of speed without stripping and shaving.

This Die Head has a floating and buffer action, special tripping and resetting devices. Floating shank construction allows Head to yield slightly in starting on work, insuring smooth thread at start, and also makes close camming for lead unnecessary.

Adjustment easily, quickly made by means of two check nuts to set up the machine for desired length of thread.

Opened and closed automatically. Opened by adjustable trip. Closed by closing attachment.

Hardened and ground throughout. Chasers positively cam controlled and rigidly held in Die Head by sliding fit between the key in the body of tool and keyway of Chaser. By merely pulling up on the Stop Plunger, Chasers may be easily and quickly removed.

Carefully inspected before it leaves our factory, it is ready for use.

IT WILL CUT SMOOTH, ACCURATE SCREW THREADS, GIVE YOU MAXIMUM PRODUCTION AND SAVE YOU MONEY!

WRITE FOR OUR BOOKLET.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN, CONN.

RIGHT NOW! ... these Low-Cost DRILL PRESSES will cure your drilling headaches

No. 1370 —Floor type 17-inch "Slo-Speed" Delta drill press with No. 2 Morse Taper Spindle and standard tilting table. Shown with motor.

When you are confronted with an urgent need for a quick increase in production capacity in connection with the U. S. armament program—you should, *at once,* check into the possibility of utilizing the low cost Delta Drill Presses. These efficient and flexible machines are in active use in plants all over the country—as production line equipment—auxiliary machines—for special set-ups—and in hundreds of tool rooms. Their first cost, and their operating costs, are low—they are sturdy, accurate and easily adaptable to your special needs.

Other DELTA Low-Cost Machines

Cut-Off Machine cuts specially and to exact lengths a wide variety of materials. Priced at one half the usual cost of machines of this type.

Metal-Cutting Band Saw cuts almost anything in metals and plastics from jig and fixture bases 1½" by 2" thick to draw die segments 6" thick.

Bench and Pedestal Grinders "that never forget their goggles"—the safest, most accurate and efficient grinders made.

New Delta Power-Feed Drill Press

Incorporate many special features and offer a wide range of feeds, from .0010 to .016 inches per revolution of spindle in the slow-speed drill presses, and from .0005 to .009 inches in the high-speed machines. This new line includes single and multiple spindle 17" units, in slow speed and high speed models, with table-raising or head-raising mechanisms, powered with either Delta or standard NEMA frame motors—all at considerably lower cost than you expect for drill presses of this quality.

Send for Catalog

Don't judge the value of Delta drill presses to your shop by their low cost. It will pay you to investigate them carefully and learn the full possibilities of these quality units that are effecting a revolution in present-day production methods. Fill out the coupon and send for the complete catalog of Delta low-cost drill presses.

DELTA
MILWAUKEE

THE DELTA MANUFACTURING COMPANY
607-E E. Vienna Avenue, Milwaukee, Wis.

Please send me catalog of Delta Machines, giving specifications and prices on Delta Drill Presses. ☐ I am also interested in Delta Cut-Off Machines ☐ Delta Metal-Cutting Band Saw ☐ Delta Grinders ☐ Delta Power Feed Drill Presses.

Name.....

Address.....

City.....*State*.....

Today

SHELLS

This AVEY drilling machine drills and taps—speedily and efficiently — 75 m/m — 90 m/m — and 105 m/m shells for defense. That's one of its jobs for today.

Tomorrow

OPERATION

Drill and tap 5/16—18 thread lock screw hole in shell nose.
Two Position Sliding Fixture.

When peacetime requirements are again first—this AVEY drilling machine—because it is standard design—retains the place for which it was originally intended—YOUR PRODUCTION LINE—certainly a wise investment—this AVEY drilling machine that will do TODAY'S JOB and TOMORROW'S JOB.

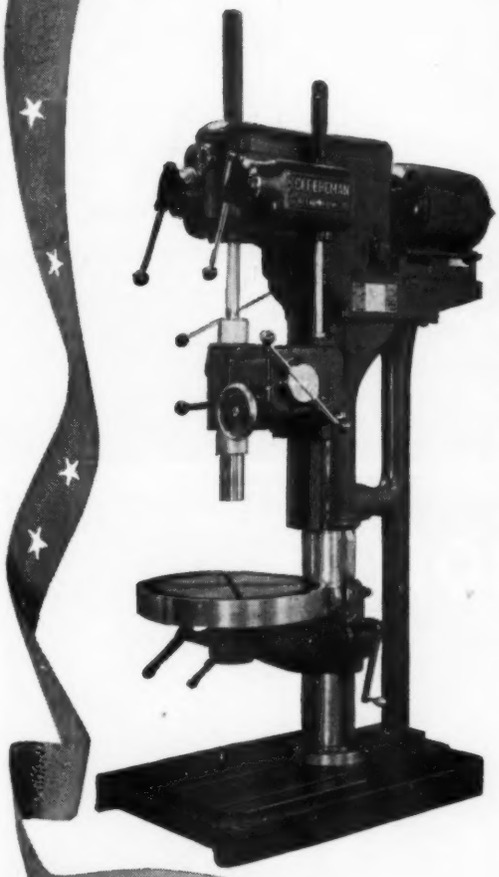
THE AVEY DRILLING MACHINE CO.
CINCINNATI, OHIO

Because this AVEY DRILLING MACHINE is standard design—your order will receive better delivery.

Avey DRILLING MACHINES
CINCINNATI · OHIO

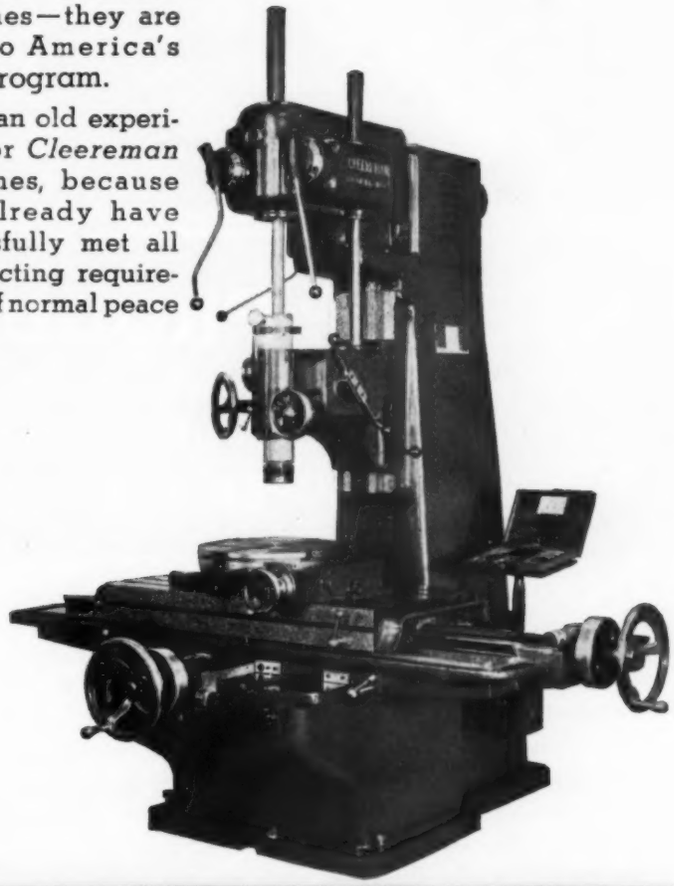
Critical Days...

"CRITICAL" *machines!*



Cleereman machines are officially designated as "critical" machines—they are vital to America's War Program.

This is an old experience for *Cleereman* machines, because they already have successfully met all the exacting requirements of normal peace times.



Bryant Machinery & Engineering Company
Sales Division
Cleereman Machine Tool Company
400 W. Madison St., Chicago, Ill.

CLEEREMAN

DRILLING MACHINES and JIG BORERS

CARD TAPS

ARE YOU INTERESTED IN BETTER TAPPING?

If better production tapping is your objective, it will be to your advantage to come to Card. We can help you because we sell better tapping performance.

The high quality of work done—the quantity produced—the economy of using Card Taps—will be apparent on any tapping job. Just put Card Taps to work and let them prove their superiority.

A regular catalog tap in most cases will meet your needs without using special taps. You'll find your requirements covered in the Card Catalog No. 34. Write for a copy.

Card taps are sold by leading dealers everywhere

S. W. CARD MANUFACTURING CO.
Mansfield, Mass., U. S. A.
DIVISION OF UNION TWIST DRILL CO

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STEP UP PRODUCTION

By taking advantage of higher speeds and feeds in indexing work with the

HARTFORD SUPER-SPACER

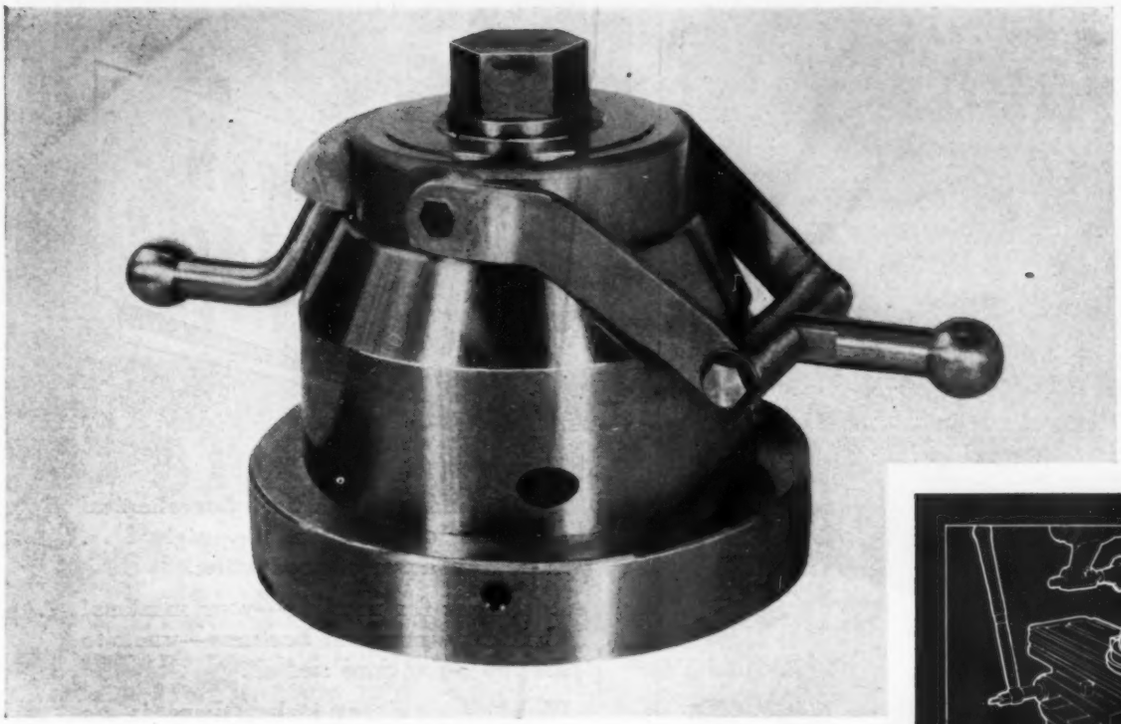
This modern, sturdy device meets all demands for higher production on indexing operations. Accuracy under heavy cuts is assured and capacity limited only by the capacity of the method employed in holding and the power of the machine tool on which the Super-Spacer is used.

The HARTFORD SUPER-SPACER can be depended on for the accurate control of all machining operations within the scope of its utility, including milling, drilling, slotting and planing. It pays for itself whether used on single pieces or many.

The Hartford Drilling Attachment, easily attached to the Super-Spacer, provides a simple, practical way to extend the utility of this device to include work ordinarily requiring expensive jigs and fixtures.

THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD CONNECTICUT

SEND FOR DETAILS OF THIS TIME-SAVING SPACING DEVICE



NEW

TWO HANDLED INDEXING FIXTURE

MAXIMUM CAPACITY 2-5/8"

Designed and built with a detachable handle for indexing a full 360 degrees.

Advantages In Service

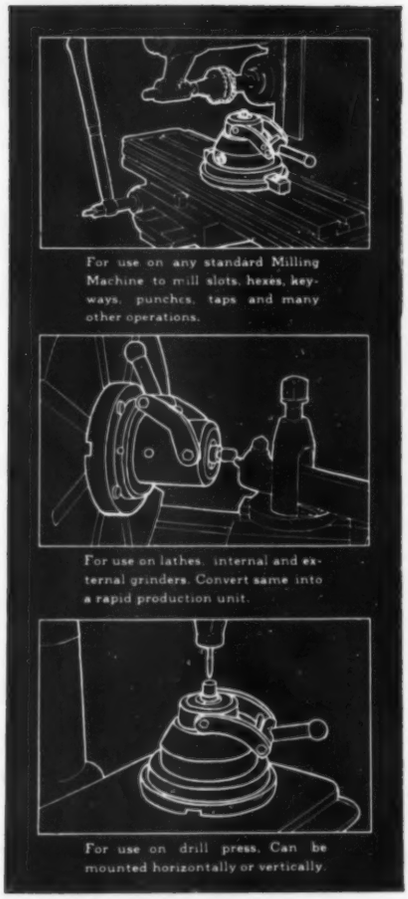
The extra handle is used to advantage where an uneven number of divisions is required around the piece and cutter cannot go clear through the work. Indexing fixture can now be used on tool room work, without index plates, for jobs where line accuracy is adequate.

Made in 1" and 2" sizes

All fixtures take Zagar Collets or can be furnished to fit any make customers' collets except B & S.

Bulletin upon request

Prompt Delivery



For use on any standard Milling Machine to mill slots, hexes, keyways, punches, taps and many other operations.

For use on lathes, internal and external grinders. Convert same into a rapid production unit.

For use on drill press. Can be mounted horizontally or vertically.

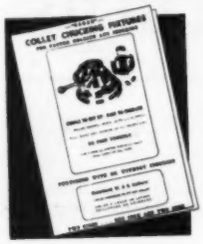
TEN DAY FREE TRIAL

PRICES

1"—Holding	$75.00
1"—Indexing	$150.00
2"—Holding	$125.00
2"—Indexing	$250.00

ZAGAR TOOL, INC.

23880 LAKELAND BOULEVARD CLEVELAND, OHIO



Zagar Tool, Inc., Cleveland, Ohio

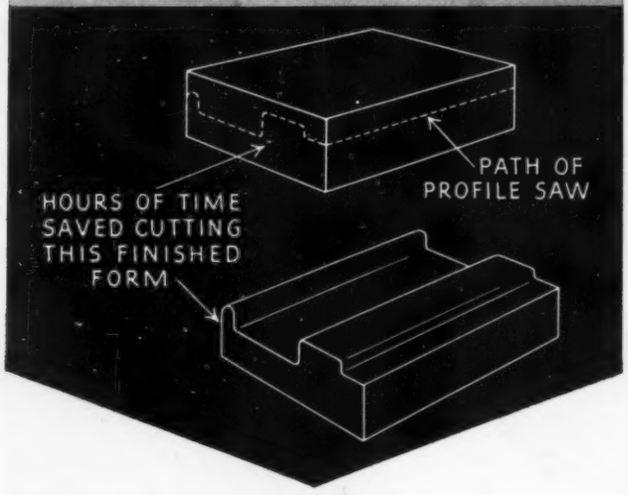
Please send me data on your new two handled indexing fixture.

NAME .....

COMPANY .....

ADDRESS .....

★ STEP UP ★ PRODUCTION



WITH

MILFORD

★ PROFILE SAW ★

YES . . . a contour sawing machine, or any good vertical band saw machine, with fixtures, will do a real job. Equipped with MILFORD PROFILE SAW you make a real saving to boot.

Your basic machine tools can be kept on straight production work by cutting all complicated shapes, such as parts of all kinds, special tools, dies and jigs, this up-to-the-minute way.

Remember . . . a machine for contour sawing is no better than its saw. The saw does the cutting, not the machine.

MILFORD PROFILE SAW is made by the world's largest, most experienced producer of metal cutting band saw. It is carried in stock by Mill Supply Distributors in every locality.

Perhaps you have a band saw machine that can be easily adapted to Profile Sawing. If so, write us at once for directions. Write also for a free sample of MILFORD PROFILE SAW, giving specifications of blade you now use and description of cutting job and machine.

THE HENRY G. THOMPSON & SON COMPANY
NEW HAVEN, CONNECTICUT
Also makers of MILFORD REZISTOR HACKSAW BLADES

THIS is more than a war of mechanical monsters clashing in the night . . . more than a war of production.

It is a war for markets—*your* markets! The Axis wants your business—wants to destroy it for once and all.

With so much at stake, there is no doubt you will want to do everything you can to meet this Axis threat. Two ways are open: Speed production and BUY BONDS. The only answer to enemy tanks and planes is *more* American tanks and planes—and your regular, month-by-month purchases of Defense Bonds will help supply them. Buy now *and keep buying*.

HOW THE PAY-ROLL SAVINGS PLAN HELPS

When you install the Pay-Roll Savings Plan (approved by organized labor), you not only perform a service for your country but for your *employees*. Simple to install, the Plan provides for regular purchases of Defense Bonds through voluntary pay roll allotments.

Write for details *today!* Treasury Department, Section R, 709 Twelfth Street, NW., Washington, D. C.

U. S. SAVINGS

Bonds ⋆ Stamps

This space is a contribution to Victory by

AMERICAN MACHINIST

DSS-285 16—27199-1 U. S. GOVERNMENT PRINTING OFFICE

Accuracy, fine finish and speed are synonymous with the AMMCO

HI-SPEED HONING and LAPPING MACHINE

A flexible machine that is the last word in simplicity of operation

HONES CYLINDERS up to 24" in diameter . . . with STROKES from 20" to 72" . . .

IDEAL FOR PRODUCTION JOBS INVOLVING:

Aircraft parts . . . Ordnance parts . . . Diesel engines . . . Compressors . . . Pumps . . . Internal combustion engines . . . Steam cylinders, etc.

Speed up war work involving internal cylindrical surfaces by utilizing a HI-SPEED Honing Machine. It produces accurate, straight, round, smooth bores—amazingly fast.

Unique positive stop and dwell system makes it possible to stop the spindle without shock or impact at the bottom of each stroke or at any point within the stroke range, and hold the spindle without reciprocation, at that point up to 1½ minutes. Ideal for "blind hole" honing and straight line lapping or honing.

All controls are located at the front of the machine at the operator's station . . . No ladders to climb . . . Stroke setting, hone withdrawal, short stroking at any point, changes in speed of reciprocation or rotation of the spindle made instantly from operator's station.

The HI-SPEED Honing Machine is made in 4 sizes, any one of which can be had with strokes up to 72"...Designed for use with any standard make of honing head.

Tell us your requirements—and our engineers will promptly furnish you with complete information, prices and early delivery dates.

Illustrated is No. 0 Machine equipped for 36" stroke with 80" under the spindle.

NOTE THESE SPECIFICATIONS:

Model No.	No. 0	No. 1	No. 2	No. 3
Stroke (standard)	20"	36"	48"	72"
Working Base Area (standard) Auxiliary Tables available	21" x 22"	31" x 31"	31" x 31"	48" x 54"
Height Under Spindle Nose (up) Added Height Available on Order.	48"	60"	75"	100"
Spindle Diameter	2⅛"	2½"	2½"	2¾"
Spindle Speeds Through Gear Box	4	4	4	8
Main Drive Motor (standard)	7½ hp	10 hp	15 hp	20 hp
Coolant Pump Volume, Motor Driven	14 gpm	18 gpm	18 gpm	25 gpm
Maximum Bore possible to hone with standard spindle drive motor	10" Dia.	12" Dia.	16" Dia.	20" Dia.
Maximum Overall Diameter of Cylinder possible to place on standard base	18"	27"	27"	44"
Floor Area	44"x60"	60"x80"	60"x80"	60"x108"
Overall Height	11'6"	15'3"	18'3"	23'8"

NOTE: Under our new policy of distribution, sales territories are being assigned to financially responsible, established dealers in the machine tool field. A few excellent territories are still open, and dealers are cordially invited to write us relative to sales representation.

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Avenue, North Chicago, Illinois

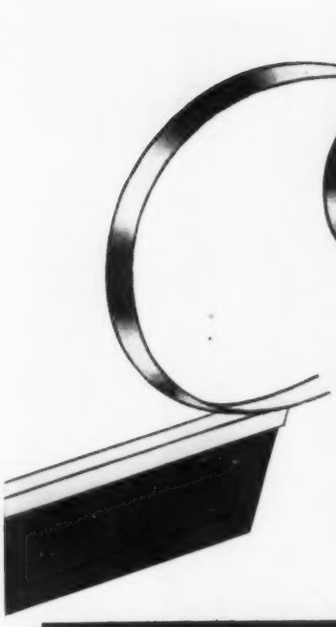
Friction REDUCED!

THROUGH THE USE OF

EMPIRE TOOL COMPANY'S

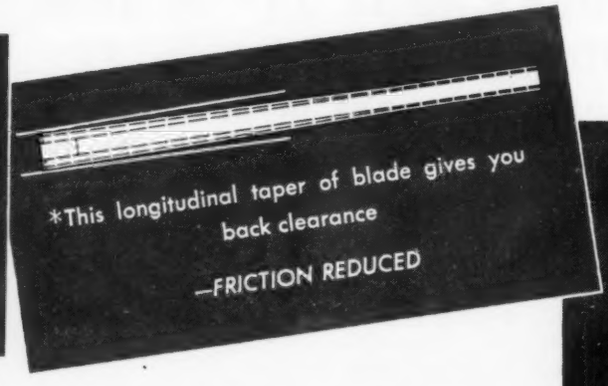
LUERS PATENTED

CUTTING-OFF BLADES



This "T" shaped blade gives you liberal side clearance

—FRICTION REDUCED



*This longitudinal taper of blade gives you back clearance

—FRICTION REDUCED

This hollow-ground top of blade relieves restriction of chip expansion

—FRICTION REDUCED

No More Troubles in Cutting-Off Operations

The elimination of excessive friction — the cause of nearly all breakdowns in cutting-off operations — brings you elimination of many troubles. Breakdowns disappear — tools stay on the job for longer periods — more work produced in any given time — work is made easier — less attention to operation required — all these features spell more efficient production for you — made possible by the unique design and construction of the blade.

PRODUCTION IS INCREASED
DOWNTIME IS REDUCED
NUMBER OF REGRINDS CUT DOWN
WASTE TIME AND MATERIAL ELIMINATED

Luers Patented Cutting-off Blades are used on any type of hand or automatic screw machines. Write us on your letterhead the make and size of your machine, and we will let you try these tools in your own plant so you can fully realize their high efficiency. Very simple to operate—even in hands of unskilled help.

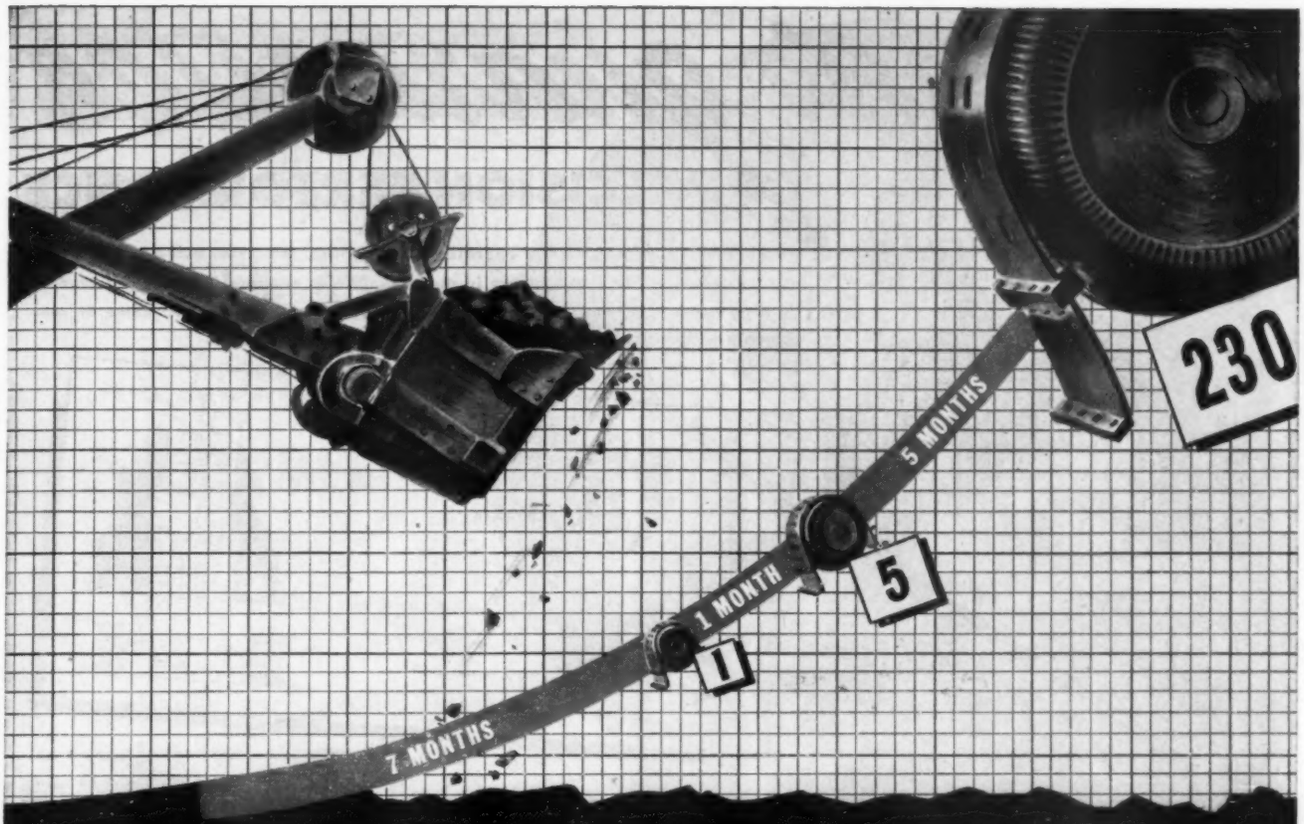
PRODUCED UNDER LICENSE ISSUED BY JOHN MILTON LUERS PATENTS, INC

* Blades, both tapered and parallel on the longitudinal cutting width, carried in stock.

The Blades that reduce friction

EMPIRE Tool Co.

8778 Grinnell Ave.
Detroit, Mich.



How Industrial Distributors helped a Generator Manufacturer to start production ahead of schedule

Have *you* learned how to utilize your Industrial Supply Distributor's ability to help you through production emergencies? One big Western manufacturer, rushing a war plant to cover nearly Two Million feet of floor space, discovered that a large volume of important machinery was desperately needed but hadn't even been ordered.

Threatened by heavy penalties, Management called in local Industrial Distributors, who:—

1—Opened up new sources of supply and delivered equipment as fast as it could be installed.

2—Helped the Purchasing Department secure its first stocks of materials and set up a system for keeping further supplies coming on schedule.

With co-operation from everyone, the Manufacturer produced his first unit within 7 *winter months* after ground was broken.

In 60 days, 25 additional units had been completed, and 4 months later, almost 400 more. Output has since moved rapidly toward the monthly capacity of 1,000 units.

We hope you are depending on your Mill Supply House with the same confidence when *buying*, that we do when *selling*. For Cle-Forge High-Speed Drills and Peerless High-Speed Reamers reach your stock-rooms through Industrial Distributing channels exclusively.

This incident is typical of the unusual services that many Mill Supply Distributors are rendering their customers during the Emergency.

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

30 READE ST. NEW YORK · 9 NORTH JEFFERSON ST. CHICAGO · 650 HOWARD ST. SAN FRANCISCO
6515 SECOND BLVD., DETROIT · LONDON - E. P. BARRUS, LTD. - 35-36-37 UPPER THAMES ST., E.C.4

"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

Vernon's guarantee

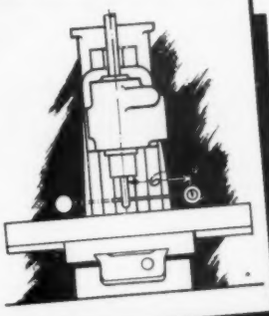
OF PRECISION PERFORMANCE

Here's one reason why skilled operators everywhere place their confidence in the Vernon Vertical Mill and Jig Borer—THE VERNON IS PRECISION BUILT!

The critical tolerances below are typical of the many exacting inspections passed by every Vernon . . . Your guarantee of split-thousandths accuracy!

Squareness of table top in relation to spindle. Indicate using 6" radius. Indicator reading not to exceed .0005" variation in 12" sweep.

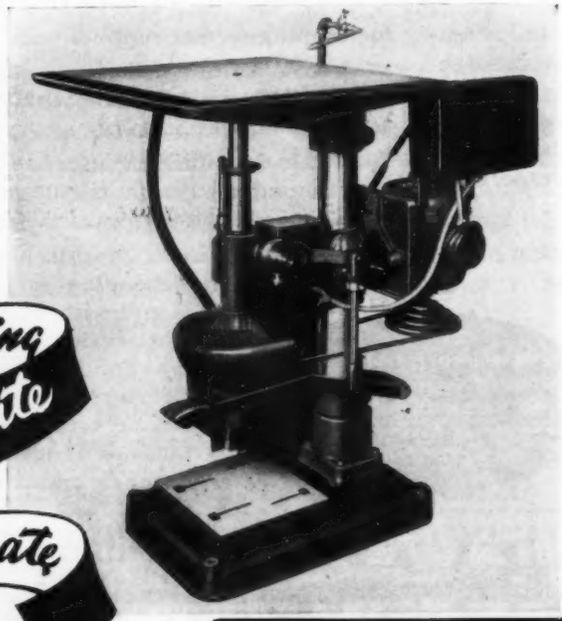
Squareness of quill travel in relation to top of table. Sliding head gib lock secure. Indicator reading not to exceed .0005" variation in full 3" travel of quill.



See the Vernon Vertical Mill and Jig Borer at your dealer's, and write for informative bulletin!

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST., VERNON LOS ANGELES, CALIFORNIA
Vernon Line of **HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS**

Here's MECHANIZED SPEED



Time Saving
Accurate
Easy to Operate

for your Back Spot-Facing

Slow hand operations are eliminated by the new, efficient Buffalo machine for back spot-facing, back counter-boring and back finishing of areas surrounding previously drilled holes. Table has large working area. Convenient foot feed, which actuates motor "plugging" control. When foot feed is released the spindle is stopped. Efficient coolant system. The Buffalo *Back Spot-Facing* Machine may be fitted with several types of operating switches. Bulletin F-3322 on request.

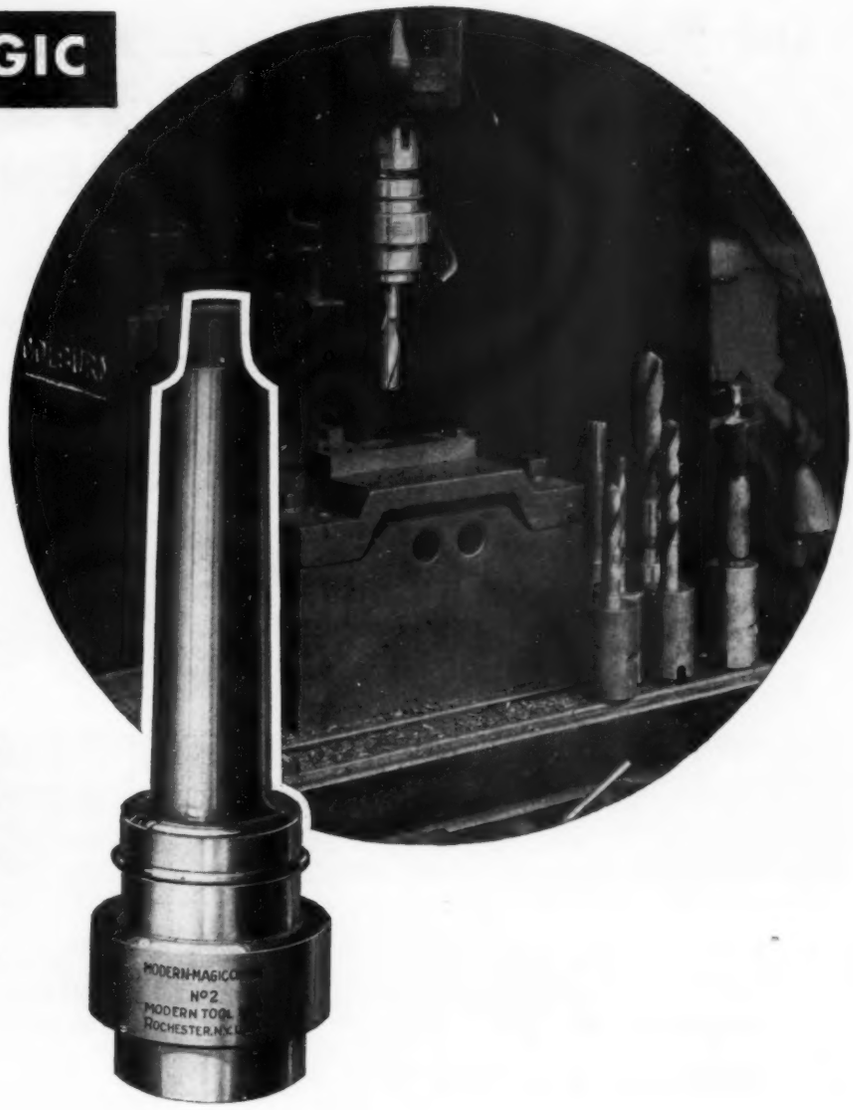
BUFFALO FORGE COMPANY
448 Broadway Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" BACK SPOT-FACING MACHINES

MODERN-MAGIC

QUICK CHANGE CHUCK AND COLLET EQUIPMENT

Has reduced the idle time of revolving spindles to practically zero. With this chuck in revolving spindle machines, tools can be changed while the machine is running without stopping or even slowing down the spindle.



QUICK DELIVERY

We can make reasonably quick delivery on practically any size MODERN-MAGIC QUICK Change Chuck and Collet equipment.

MODERN TOOL WORKS

DIVISION OF CONSOLIDATED MACHINE TOOL CORPORATION

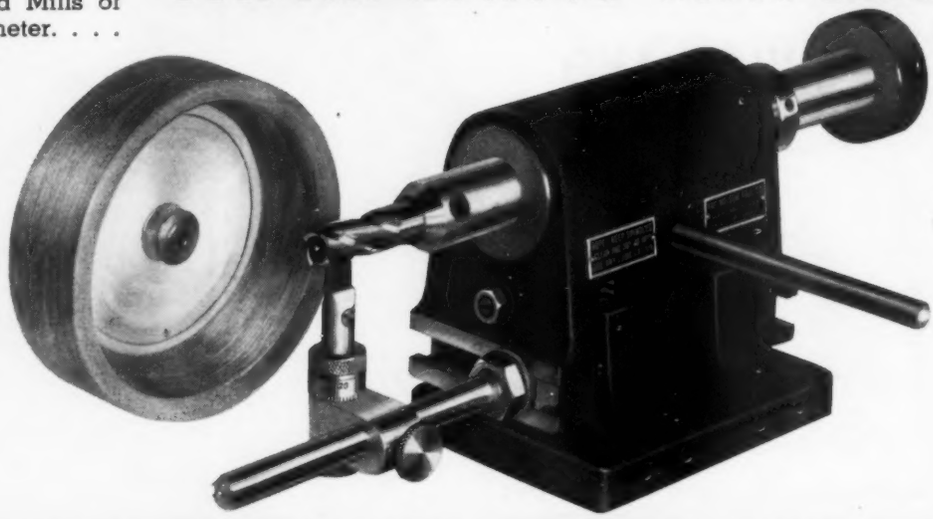
ROCHESTER **NEW YORK**

End Mills are Scarce . . . Make 'em Last . . . With the WELDON SHARPENING FIXTURE

COMPLETE! SELF-CONTAINED!

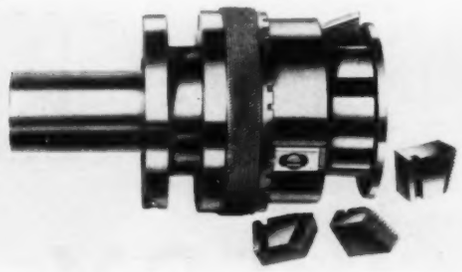
Quickly re-sharpens End Mills of ⅜" to 1¼" shank diameter. . . . Requires no centers or lead cams. . . . Releases major production equipment. . . . Designed for any grinder with flat table. . . . No table movement necessary. . . . Operated by trained or unskilled workers. . . . Provides tool conservation — a vital war factor.

SIMPLE!
CONVENIENT!
FLEXIBLE!



THE WELDON TOOL CO.
3002 WOODHILL ROAD • • CLEVELAND, OHIO
"Yesterday's Pioneer—Today's Leader"

End mills • ground circular and ★ flat form tools • screw machine ★ cams • "Tu-Lip" counterbores



R-S REVOLVING TYPE YOKE CONTROLLED DIE HEAD

RICKERT SHAFER *Specialists* IN THREADING TOOLS

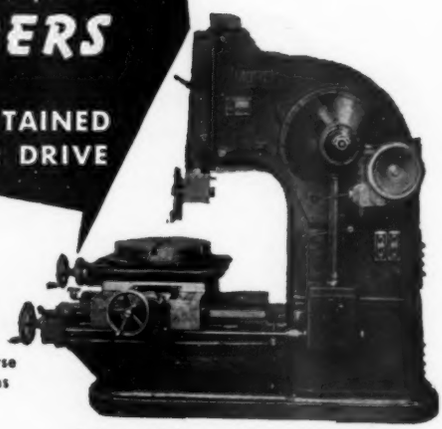
- AUTOMATIC DIE HEADS
- COLLAPSIBLE TAPS
- BORING HEADS
- FRICTION TAPPERS
- SPECIAL THREADING MACHINES

The RICKERT-SHAFER Co.
ERIE, PA.

Accurate, High-Speed
MOREY VERTICAL SHAPERS

8" STROKE
12" STROKE

SELF-CONTAINED MOTOR DRIVE



power rapid transverse feeds in all directions

Timken Tapered Roller Bearings for Main Spindle—all others anti-friction.

Built to highest accuracy standards the MOREY VERTICAL SHAPER is simple for tool-room manufacturing. Power feeds and power rapid transverse feeds in all directions are instantly available in all operating positions.

Ask for Circular 726

MOREY MACHINERY CO., INC.
410 Broome Street New York, N. Y.

Announcing

SERIES "RS"

THE NEW NAMCO COLLAPSING TAP

with

- ✓ **Quick and positive opening for close-to-shoulder threads.**
- ✓ **Fine diametric adjustment and ground thread chasers — for high precision work.**
- ✓ **One design: for stationary spindle machines — as shown; for revolving spindles — without resetting handle and trip ring.**
- ✓ **Five sizes — 1-1/4 min. to 2-13/16" max. with blade chasers. Larger sizes up to 5" with circular ground thread chasers.**

COMPANIONS IN PERFORMANCE WITH NAMCO CIRCULAR CHASER DIE HEADS

THE NATIONAL ACME CO.

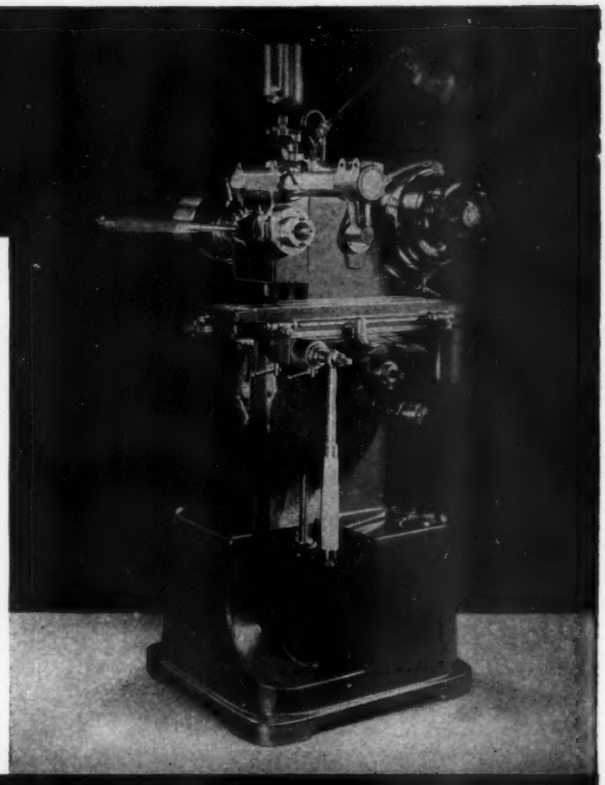
170 EAST 131ST STREET • CLEVELAND, OHIO

ACME-GRIDLEY 4 -6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • SOLENOIDS • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING

★ ★ STEP UP PARTS PRODUCTION AT LOW INVESTMENT COST

. . . with the

NICHOLS HAND MILLING MACHINE



Substantial savings in production milling are assured by the Nichols Hand Miller—a precision machine which combines the usual features of conventional hand millers with the ruggedness and in-built accuracy of modern high production machine tools.

OUTSTANDING FEATURES INCLUDE:

. . . one piece box section column with adequate slides for head and knee integrally cast

. . . heavy box section. Knee with extra long dovetail slides for both vertical adjustment and horizontal traverse

. . . table, fitted with oil pockets at ether end can be operated from either side of machine and locked in any position; standard equipment includes micrometer table stops; table feed screw optional.

. . . hand operated vertical head fitted with hand set depth stop; can be locked in any position.

. . . spindle hardened and ground mounted on Timken Precision Roller Bearings

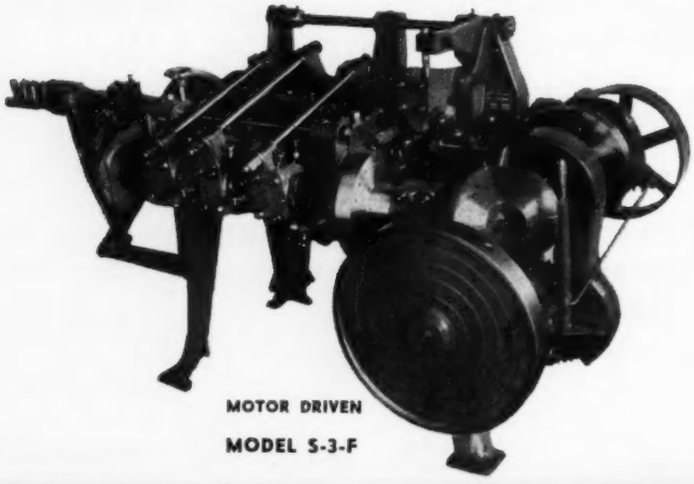
. . . capacity: longitudinal feed 10"; traverse feed 7".

» WRITE FOR COMPLETE DETAILED SPECIFICATIONS «

W. H. NICHOLS & SONS *Waltham, Mass., U.S.A.*

NILSON *Automatic Metal and Wire Forming* MACHINES

. . . assuring faster work and greater uniformity in parts produced . . . . . .



MOTOR DRIVEN

MODEL S-3-F

The new Nilson Ribbon Stock Forming Machines are a development—the result of more than fifty years specialization in the design and building of metal forming machines. They can be depended on for speed, durability and accuracy and are built in 4 sizes for handling from 3/32" to 1¼" in diameter and stock from 1¼" to 2½" wide.

Outstanding features include:

. . . open construction of the press and forming tools

. . . patented slide feed has independent cam-operated wire gripping device

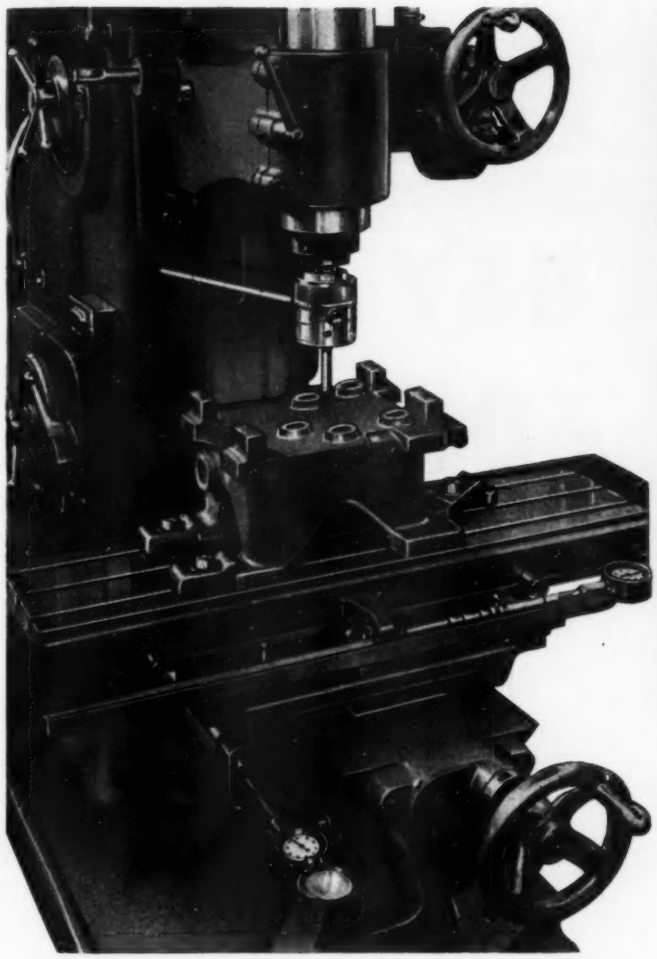
. . . power operating wire feed is transmitted through a straight line.

ILLUSTRATED BULLETIN GIVING DETAILED SPECIFICATIONS . . . .

available on request

Nilson is prepared to design and produce special automatic machinery of high productive capacity. Our long experience in this class of work enables us to offer an expert and comprehensive service on special machines. Outline your problem—ask for our recommendations.

THE A. H. NILSON MACHINE CO... *Bridgeport, Conn., U.S.A.*



A typical jig boring job is done on a KNIGHT Miller. With dial indicators, all five holes were accurately located and bored. At the same setting, the corner pads were milled, insuring squareness with the bored holes.

- Internal and external milling is done at one setting
- Step milling is made easy by getting vertical adjustment on spindle
- Profiling, boring, and slot-milling is all done at one setting
- Precision boring is done, using dial indicators for accurate locating
- Rigid spindle makes possible deep end milling
- Jig boring is possible because of dial indicators
- In experimental work you can machine many jobs completely on this one machine and handle difficult operations without special equipment
- For limited and special production you can keep costs down and maintain quality without special tooling

Wide Range

KNIGHT Millers ADD SPEED TO EACH SHIFT'S PRODUCTION···

KNIGHT VERSATILE MILLERS ACCURATE · RIGID

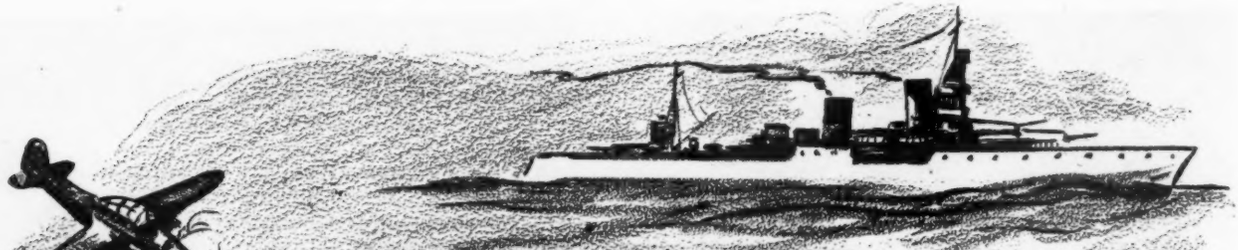
Large work or small—milling or boring, roughing, or accurate finishing cuts—all are handled to equal advantage on this wide range machine. Sixteen changes in speed, in either direction, give the spindle ample range to meet a wide variety of requirements.

Greater speed is realized by users of KNIGHT Millers because of (1) the short time required to make set-ups, particularly difficult ones (2) the elimination of additional set-ups or at least the simplification of them (3) the quick and accurate location of holes and surfaces, especially when dial indicators are used (4) the quick change of vertical settings by moving the spindle instead of the work (5) the fast method of changing cutting tools (6) the swiveling table which greatly reduces the most expensive element in tool room operation—that of time waste in set-up work.

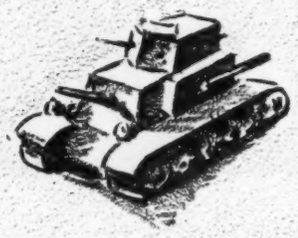
●

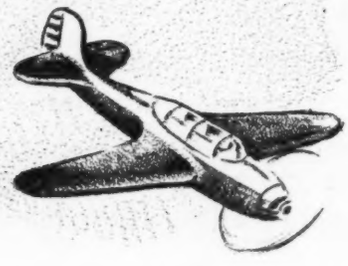
WRITE FOR NEW CATALOG

W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •



MURCHEY TAPS and DIES





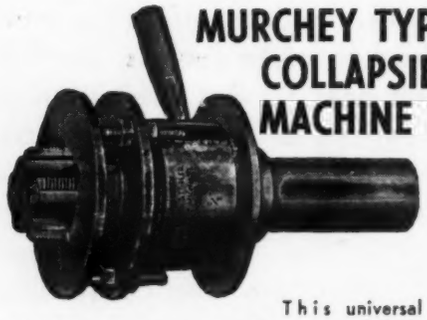
are handling every class of war production work

Bombs, shells, aircraft, machine guns, gun carriages—in fact thread production on war and ordnance equipment of all kinds is being handled smoothly and accurately under fast production schedules with Murchey Threading Tools.

MURCHEY ALSO MANUFACTURES

Thread Milling Machines, and Shell Tapping Machines. Full details available on request.

MURCHEY TYPE "M" COLLAPSIBLE MACHINE TAP



This universal type tool provides instant, positive collapse. It is designed for tapping straight threads. Adjustable for thread size—sturdy—strong—a time and money saver under all conditions.

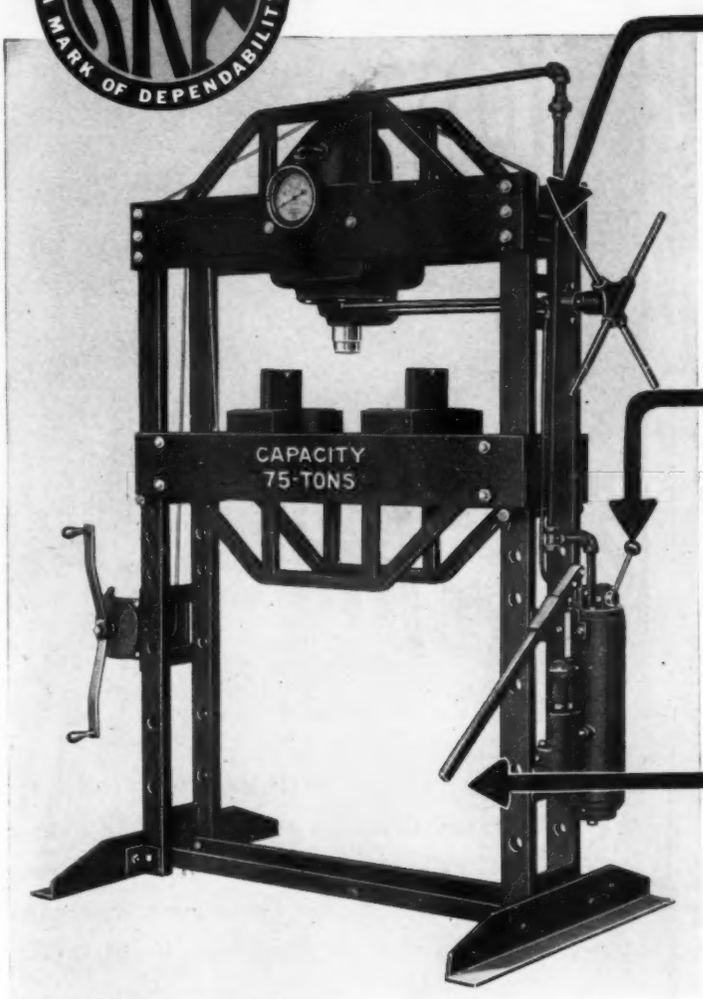
MURCHEY TYPE "G" SELF-OPENING DIE HEAD

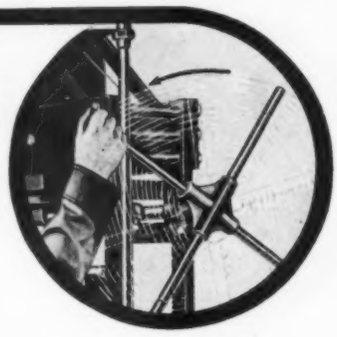
Designed for use on hand screw machines, this non-rotating tool is fast, accurate and economical. High thread production at low cost is assured.

Murchey MACHINE & TOOL CO.
.....DETROIT, MICHIGAN

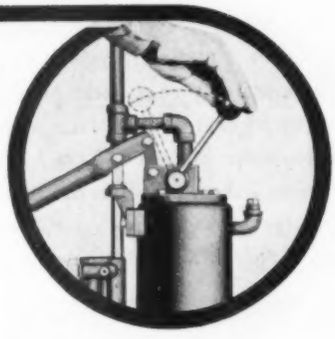
Here's how SPEED is built into HYDRAULIC ARBOR PRESSES

SINCE 1916 KRW A MARK OF DEPENDABILITY

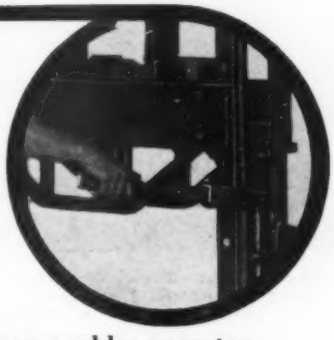




1 SPIN THE HANDWHEEL and the ram speeds to the work by fast mechanical action instead of slow, laborious hydraulic pumping.



2 FLIP THE BALL ARM to close the valve instead of slowly turning a handwheel type control.



3 START PUMPING and immediately get tons of pressure on the work because the hydraulic cylinder was automatically filled with oil during operation No. 1.

● The new KRW Presses are designed for SPEED... *speed* in bringing ram to the work ... *speed* in developing hydraulic pressure... *speed* in raising ram to remove the work. The "capstan" type handwheel raises the ram with the same mechanical speed employed in lowering it.

A *Two Speed Pump*, controlled by a quick, half turn of a finger lever, enables operator to select the speed best suited to the job—the double plunger action is 2½ times faster than the single action. Write for bulletin describing 25, 50 and 75 ton presses—priced from $198.00*.

*Prices F. O. B. Arcade, N. Y. Slightly higher west of Rockies

K. R. WILSON

MAIN OFFICE: LOCK ST., BUFFALO, N. Y., U. S. A.
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WEST COAST: Osborne Mach. Co., San Francisco, Calif., U. S. A.
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MAIL THIS COUPON

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Please send Hydraulic Arbor Press Bulletin No. 38.

Name .....
Address .....
City ..... State .....

Victory production has created an unprecedented demand for power press products. This has necessitated vast numbers of both men and women operating presses who never operated them before. It is, therefore, more essential than ever that the manufacturer equip his power presses with effective safety devices. The Schrader Pneumatic Safety Press Controls are ideal for this purpose. They are thoroughly reliable safety controls that can be quickly installed on existing mechanically controlled machines without extensive alterations. All necessary equipment is assembled in sets so that plant maintenance men can easily apply them.

Many installations made for reasons of safety prove that Schrader Pneumatic Controls relieve fatigue of the operator and result in increased production.

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Send for this 48-page catalog and service manual that shows Pneumatic Controls, Ejection Sets, Air Guns and Fittings with their component parts and accessories. Air will generally do the job better. Write today.

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AND MACHINE CONTROLS

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Division of Scovill Manufacturing Company, Incorporated

WHERE TIME COUNTS

you can count on McCrosky tools. Take McCrosky's JACK-LOCK Face-Milling Cutter. It gives longer blade life, guarantees shorter down-time. And when milling speeds and feeds are stepped up, the McCrosky JACK-LOCK Wedge insures rigidity. Quick locking and unlocking of wedges, too. Adjusting screws behind the bars mean a minimum of blade stock removal in resharpening.

Ask for McCROSKY BULLETIN *15-M.*

EST.
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McCROSKY
TOOL CORPORATION
MEADVILLE,
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FERRACUTE AUTOMATIC PIN CLUTCH

HELPS SPEED 'CHANGE-OVER'

Easy adaptability protects nation now---protects markets after the duration.

Owners of FERRACUTE PRESSES are now---and will be later---grateful for the quick and economical adaptability of all FERRACUTE PRESSES. In particular, the FERRACUTE Automatic Pin Clutch is proving extremely valuable because---

1. It can be adapted to compensate for extra heavy dies.
2. To allow time for various automatic attachments.
3. To provide a "safety" single-stroke mechanism.
4. Or a continuous operating press for high-production lines.

Standard equipment on all small and medium-sized FERRACUTE PRESSES, the Ferracute AUTOMATIC PIN CLUTCH is a complete, compact unit of clutch and brake assembled together---an exclusive feature, found on no other press.

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MACHINE COMPANY
Bridgeton, N. J., U. S. A.

TRADE FERRACUTE MARK

Belt link for Vickers type machine gun produced complete one per stroke from flat material, 140 completed links per minute.

Make precision Munitions Stampings FASTER on Dieing Machines!

Cartridge clip for caliber .303 rifle produced complete one per stroke, 120 per minute.

Including Broaching. Airplane fuselage hinge of duralumin produced complete per stroke in continuous strip to high precision limits, including **BROACHING.**

8 operations performed at every stroke convert flat material into completed shells 4800 per hour from .050" steel with 13/8" draw.

Unique features enable Dieing Machines to give unequalled high production combined with precision of product within .0002" limits when required. Consequently, these advanced automatic presses are making the majority of machine gun belt links, as well as an endless variety of munitions and industrial stampings vital to the war program: 1 to 20 finished stampings are produced COMPLETE PER STROKE from flat material, at speeds up to 600 s.p.m., with such superior die alignment that the life of these valuable tools is customarily increased 600% to 1200%. Capacities: 10 tons to 300 tons.

Complete per stroke

STAMPINGS

Mechanical time and contact fuse parts
Rifle components
Cartridge Clips, or rifle chargers
Gas mask stampings
Ammunition stampings
Bomb components
Shell parts
Detonator stampings
Airplane instrument, engine and fuselage parts

OPERATIONS

Bullet assembling
Primer inserting
Automatic time and contact fuse assemblies

Request Catalog 42

THE HENRY & WRIGHT MFG. CO.
483 Windsor St., Hartford, Conn.

Henry & Wright Dieing Machines

Do you know gages and their proper use?

What is the proper kind of gage for a specific type of work? How are gages constructed? How are they used? Fred Colvin, out of his wide and intimate experience, has set down in a practical, workable manual the essential facts about gages of all types—how they are made, how to use them, which types are best for specific jobs, how to use them in inspection work.

Just Published

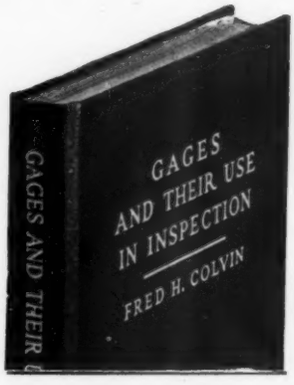
Gages and Their Use in Inspection

By Fred H. Colvin
Editor Emeritus, *American Machinist*
157 pages, 5½x8, 71 illustrations, $1.50

This book describes all types of gages, from calipers, Verniers, Micrometers, Measuring Blocks, etc., up to the latest electrolimit gages. Tolerances, limits, and allowances are carefully defined and explained, and many practical kinks and suggestions on inspection are included.

Here is what the book covers—

1. Gages and How They Are Used
2. Measuring Instruments In Common Use
3. Types of Gage
4. Gage Tolerances and Gage Wear
5. Gage Blocks and Dial Gages
6. Reed and Air Gages
7. Threads and Thread Gages
8. Special Types of Gages
9. Interchangeable Manufacture and Inspection
10. Salvaging and Selective Assembly
11. Kinds of Fit



"A thorough understanding of gages and their use will make it easier for both workmen and inspectors, and it may easily open the way for a workman to graduate from the machine to the inspection department."

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McGRAW-HILL ON-APPROVAL COUPON

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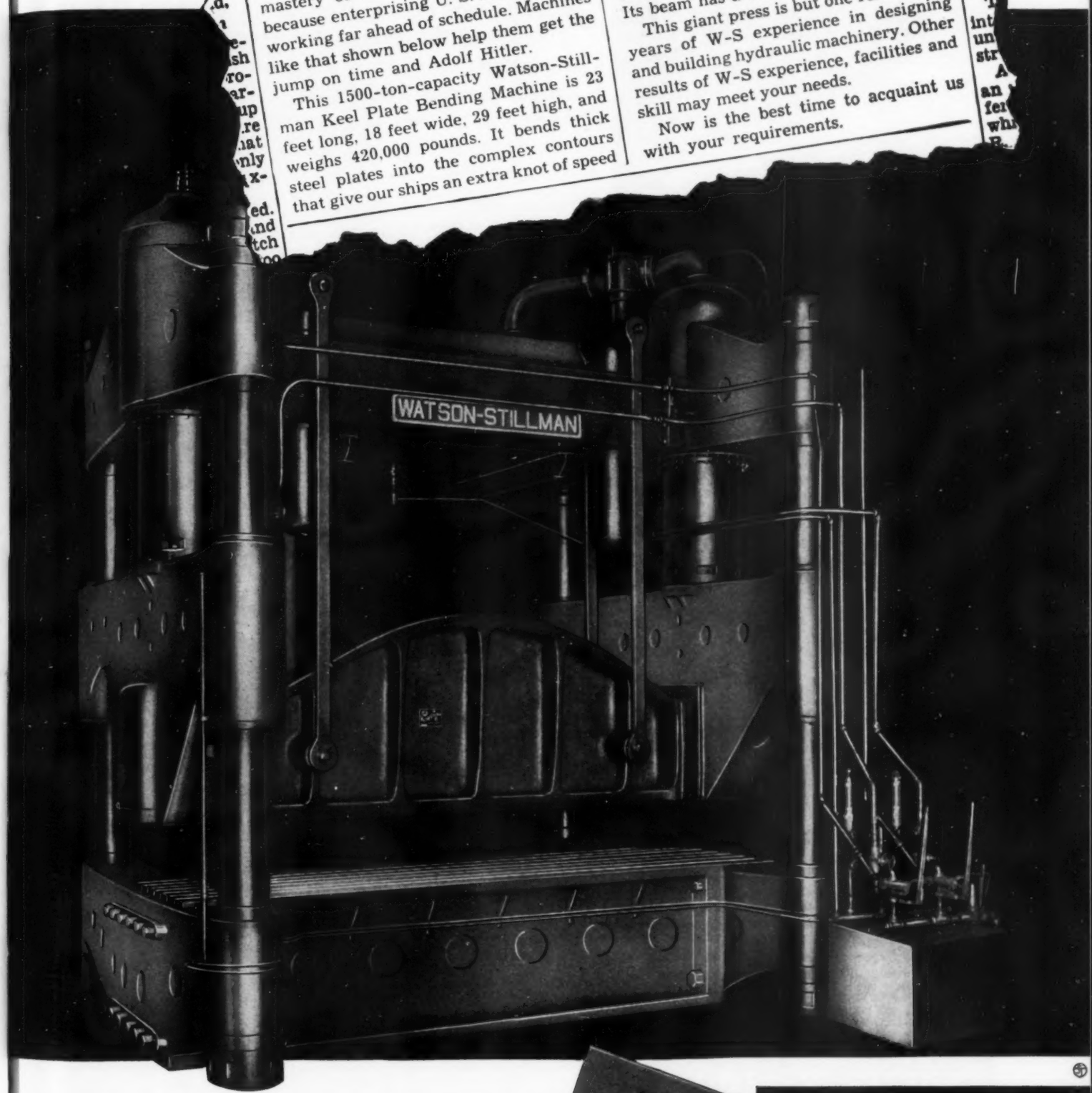
METALWORKING MAMMOTH HELPS SHIP PROGRAM

America and England continue to hold mastery of the high seas—but largely because enterprising U. S. shipyards are working far ahead of schedule. Machines like that shown below help them get the jump on time and Adolf Hitler.

This 1500-ton-capacity Watson-Stillman Keel Plate Bending Machine is 23 feet long, 18 feet wide, 29 feet high, and weighs 420,000 pounds. It bends thick steel plates into the complex contours that give our ships an extra knot of speed or save an extra barrel of precious fuel. Main rams are 36 inches in diameter, the platen 6 feet by 22 feet. Its die bolster is 22 feet long and 1 foot, 10 inches wide. Its beam has a 4-foot stroke.

This giant press is but one result of 95 years of W-S experience in designing and building hydraulic machinery. Other results of W-S experience, facilities and skill may meet your needs.

Now is the best time to acquaint us with your requirements.



FREE! Hydraulic Handbook

Bulletin 120-A—12-page hydraulic engineer's handbook—is yours for the asking. Capacities of Hydraulic Rams; Orifice Discharge of Water; Seamless Pipe Properties; Strengths of Materials; etc., etc. No advertising. Write The Watson-Stillman Co., Roselle, N. J.

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Engineers and Manufacturers of Hydraulic Machinery and Equipment—Hydraulic Presses, Pumps and Jacks, Forged Steel Valves and Fittings

The standards of excellence which govern every operation in the manufacture of "American Swiss" Swiss-Pattern Files require a craftsmanship that is learned only through long years of experience. This old timer, engaged in "stripping" file blanks, has the responsibility of finishing the smooth, even surface that is necessary to form sharp teeth of uniform height. He, and every other "American Swiss" mechanic, knows that perfect results in his own operation is essential to the final perfection demanded for each finished "American Swiss" file. This is one of the reasons why these precision tools are preferred by tool and die makers all over the country.

AMERICAN SWISS FILE & TOOL CO. • ELIZABETH, NEW JERSEY

American Swiss
SWISS-PATTERN FILES

Speed up Your Production!

HANDLE YOUR CUTTING-OFF OPERATIONS (3" and larger) ON THIS NEW MACHINE . . . . .

The Porter-McLeod Cold Metal Sawing Machine will definitely step-up your production and quickly pay for itself when you have to cut stock 3 inches and up.

An outstanding production cutting-off machine, with modern enclosed motor drive and centralized controls, the new 8" Porter-McLeod will handle single pieces or permit nesting of bars or shapes for cutting off multiple units simultaneously.

Feed of blade upward to the stock provides blade protection against riding or bumping. Support of blade near its rim prevents buckling and maintains accuracy of cutting. By pulling blades through the cut, large size stock can be cut with less power and with assurance of a straight cut. Standard feed of the machine is 3 inches per minute and is made by means of a friction disc which insures against blade breakage especially when coming in contact with hard spots in the stock being cut. Feed can be increased for cutting brass and other non-ferrous metals.

Regardless of the material to be cut, you can depend on this machine for the utmost in productive capacity, economy and speed.

The machine is driven by a 5 H.P. 1800 R.P.M. motor and is equipped with magnetic switch and push-button station. Detailed specifications available on request.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U. S. A.

MACHINE TOOL COMPANY

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KIRK & BLUM

WELDED MACHINE BASES, PEDESTALS and FRAMES
LATHE PANS
GEAR and BELT GUARDS
Pressed Steel Louver Panels and Cover Plates
THE KIRK & BLUM MFG. CO.
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WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.
EASTERN TOOL & MFG. CO.
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QUALITY

SCREW MACHINE PRODUCTS

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WALTHAM
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Our Grey Iron Foundry, Structural and Machine Shops are at your disposal

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Medium Heavy
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CONTRACT WORK SOLICITED
ROBT. HOLMES & BROS., INC.
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METAL STAMPINGS

• *TOOLS* • *DIES* •
PERMANENT MAGNETS
HEAT TREATING
THOMAS & SKINNER
STEEL PRODUCTS CO.
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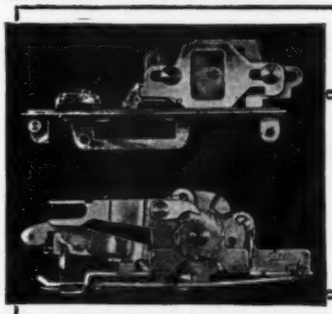
Modern one-floor plan factory of 65,000 sq. ft. strategically located at Dayton, Ohio, experienced in wide range of sheet metal work employing 14 to 30 gauge sheet steel or other sheet metal. Staffed with skilled workers. Especially equipped for square shearing and forming sheet steel with shearing capacity of four tons in eight hours; blanking and punching up to 56-ton capacity, punch press bed sizes 21" to 32"; spot and arc welding; chucking operations with P&J lathes; painting and enamel baking; complete assembling including supplementary operations, riveting, dynamic balancing equipment, etc.

Our years of experience and skilled workmen assure you a quality job at a reasonable price. Send us blue prints and complete data on your work for specific quotations. Or ask for one of our representatives to call with complete inventory of our equipment, capacities, etc. He'll be glad to obtain the information for you. Write, wire, or phone Dayton, ADams 7239.

THE LAU BLOWER COMPANY
Dept. 100A—2001-2029 Home Ave. Dayton, Ohio



STAMPINGS and ASSEMBLIES

We can make long or short runs in any metal. Our modern equipment and methods, backed by 30 years of experience, are your guarantee of satisfaction. Our manufacturing facilities also include screw machine products, tools, dies, jigs and fixtures.

Your order is assured of quality workmanship by skilled mechanics. We will furnish prompt quotations on your blueprints or samples. Write us today!

"Greater Savings with Greist"

THE GREIST MFG. CO. 546 Blake Street New Haven, Conn.

SUB-CONTRACT FACILITIES FOR

Hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.
Thirty Irving Place New York City
36 years experience in metal fabrication.

WE SOLVE TOOLING PROBLEMS
Designers of
TOOLS • DIES • JIGS
FIXTURES • GAGES
Our staff is experienced in tooling up, processing and designing for war production. We can handle your problem. Your inquiry entails no obligation.
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Jigs, Fixtures & Dies
Prompt Service
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We Want War Work
72 yrs. in the business
Large, medium and small
WOOD PATTERNS
NASHUA PATTERN & MODEL CO.
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• SPECIAL MACHINERY
ORDNANCE WORK A SPECIALTY
OLD COLONY ENGINEERING CO.
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PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us—we will take care of them—ask the foundries about our work—they use our patterns every day.
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JIGS, FIXTURES & GAGES
REED MACHINE & TOOL ENG.
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SPECIAL ENGINEERING WORK

ON A CONTRACT BASIS . . .
exactly to your specifications . . .

A complete and efficient service for the manufacture of machines and parts, special tools and fixtures, etc., is available to you in our modern, fully-equipped shop. We also offer cam milling facilities that will fit your requirements. You are guaranteed quality work at a reasonable cost.

Send your blueprints or samples *today* for prompt quotations at no obligation.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE CO., Bridgeport, Conn.

PUNCHINGS STAMPINGS ASSEMBLIES

Quick action on your problem! Use our manufacturing facilities as your branch factory. Well-equipped for small and medium-sized work. Investigate time-saving possibilities *today.* Send prints or samples.

M & M MANUFACTURING CORP.
FORTVILLE, INDIANA

Need steel balls

for defense assemblies ?

The Abbott Ball Company
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ABBOTT BEARING BALLS

MACHINISTS AND ENGINEERS
FIDELITY
MACHINE COMPANY
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Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmanship assure your satisfaction. Your inquiries invited.

C. VANDERGRIFT CO., INC.
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MACHINE SHOP WANTS DEFENSE WORK

Lathes, Milling Machines, Drill Presses, Riveting, Hot Dip Tinning, Jigs and Fixtures. Investigate TODAY.

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NEED SUBCONTRACTORS?

If you can't find the facilities or services you need advertised here, we may have the company that can help you listed in our files. Write

CONTRACT WORK DEPARTMENT
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"More Subcontracting Will Help Win the War."

—Donald M. Nelson

In an open letter to the major prime contractors handling war contracts, the War Production Board Chairman made this statement. He went on to say, "Every available idle tool that can be put to work must be put to work. This may cost more, but the job must be done fast, and experience has taught us that some prime contracts can be subcontracted as much as 90%."

Backed by the authority of Mr. Nelson, this statement bears weight. Many companies are striving to expand their production by subcontracting but, in many cases, find it difficult to locate the capacity they want. You can capitalize on this by advertising your facilities in AMERICAN MACHINIST's Contract Work Section. Production men have come to refer to this Section when they need outside help and your message, outlining your facilities, will help them. It gives you a chance to tell your story to the prime contractors as no other method can and stamps you as an alert, active company.

We would like to show you how reasonably you can reach these men and get your share of our war production job through advertising here. A postcard or letter will bring you the complete details. We think you will be pleasantly surprised at its low cost. No obligation, of course. In any case we would like to have a list of your available facilities to turn over to companies needing capacity of your type.

CONTRACT WORK DEPARTMENT
AMERICAN MACHINIST
330 West 42d St. New York City

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DESIGNING ENGINEER and detail draftsmen. Must have experience in either heavy machinery or structural design. P-248, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

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SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 32 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

WORKS MANAGERS, Factory Superintendents, General Foremen, Production Managers, Purchasing Agents, Chemists, Mechanical and Electrical Engineers, Personnel Managers wanted immediately. Salaries $3000 to $20,000 per year. Also Designers and Draftsmen of all kinds. Write for application. Confidential. Established 27 years. Harrison Personnel Service, 20 W. Jackson Blvd., Chicago.

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EXECUTIVE—wishes to transfer effort from advertising and selling to essential work in defense. Dozen years of varied executive experience. Willing to accept sacrifice in salary but hopeful of receiving responsibility on par with that previously enjoyed. Reply PW-243, American Machinist, 330 W. 42nd St., New York, N. Y.

PRODUCTION PROMOTION MANAGER wishes position involving duties of Personnel and Industrial Relations executive, combined with modern slant on production promotion. PW-244, American Machinist, 330 W. 42nd St., New York, N. Y.

INDUSTRIAL ENGINEER, employed, with comprehensive management and production experience, metal products, desires permanent position. University graduate. Married. PW-250, American Machinist, 330 W. 42nd St., New York, N. Y.

EXECUTIVE—Thirty years experience in Product Design, Production, Tooling and Factory Management. Experienced in Costs, Labor Negotiations and special Sales. American citizen. Technical Graduate. PW-249, American Machinist, 330 W. 42nd St., New York, N. Y.

CONSULTING INDUSTRIAL and Production Engineer who was general superintendent of a plant manufacturing munitions during the world war, and is still conducting manufacturing operations, will consider new connections either in a consulting or executive capacity. Experienced in the construction, outfitting, tooling and operation of medium sized plants in the metal working industries. Address Engineer, 27 Manchester Rd., Poughkeepsie, N. Y.

EXPERIENCED RESTAURANT MAN, now employed in aircraft Plant Cafeteria desires position as manager in Cafeteria or consider concession in small plant. Herbert Forbush, 107 Ashley St., Hartford, Conn.

Available

WORKS MANAGER

Medium and heavy machinery and equipment. Wide and varied experience in jobbing and mass production. Able to handle large body of help. Train supervisors. Get production. Correspondence invited.

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520 No. Michigan Ave., Chicago, Ill.

NOTICE

The following notice will be published with Positions Vacant advertisements in future issues:

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

Positions Vacant advertisers are asked to indicate their acceptance of this agreement in forwarding copy.

WANTED

SUPERINTENDENT

FOR CUTTING TOOL DIVISION

Excellent opportunity for right man. Must be competent factory superintendent, capable of handling and instructing men, understand general machine shop practice, thoroughly familiar with all phases of cutting tool production, particularly all types mill cutters. Must read blue prints, make estimates. Permanent employment with old well-established company. Good salary for right man. Write fully, giving age, experience, qualifications.

The Stanley Manufacturing Co.
Monument Ave.
DAYTON, OHIO

POSITIONS WANTED

SPRAYER—15 years experience as foreman with all types of spray guns. Will work anywhere in New York State. PW-251, American Machinist, 330 W. 42nd St., New York, N. Y.

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PATENTS—Booklet free. Highest references. Best results, Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet. "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

CONTRACT WORK

WORK WANTED — For advertisements of work wanted see names indexed under Contract Work in the Searchlight Section Index appearing on the page Facing the inside back cover.

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

WANTED

METRIC GAUGE SET

81 Pieces or Smaller
For Urgent Defense Work
P. O. Drawer "D", Brightwood Station
Springfield, Mass.

For Sale
METAL ROLLING MACHINE

5 Consecutive Stations.
2" Dia. Shafts 9" between Frames, 4" Extension.
Never Used, Motorized.

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MORRIS AND VAN WORMER
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WAR PRODUCTION
METHODS — DESIGN — QUALITY
PLANT LAYOUT — CONVERSION
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No. 66 Dietrich & Harvey Floor-type Boring Mill; 3 7/16" bar; 10x10 floor plate; outboard support; tilting table.
34" Gisholt Turret Lathe; 6¼" hole in spindle; rapid traverse; taper attachment.
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8x18 Cincinnati cylindrical grinder; md
No. 1 Lees-Bradner Gear Hobber; 14" capacity.
18" Gould & Eberhardt Gear Hobber; spdr.
30x30x8' American Planer; two rail heads.

A. R. MARSH MACHINERY CO.
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1—6" Bilgram Generator
1—Sundstrand Centering Machine
1—Ingersoll-Rand Universal Air Compressor

SIER-BATH GEAR CO., INC.
9252 Hudson Boulevard North Bergen, N. J.

TURRET LATHES

3—Jones & Lamson 2 spindle Turret Lathes, 2¼ x 24. Two machines equipped with air chucks. Serial numbers 20,000. Good condition.

MAYER A. RUBENSTEIN
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1—Nash Hytor Vacuum Pump—size #1—Type C—960 with 7½ H.P. G. E. motor on base, including starter. Bought new; used for trial only. Price $300, f.o.b.

UNIVERSAL DENTAL COMPANY
48th & Brown Sts. **Phila., Pa.**

Machine Shop for Sale
Located in Louisiana

10 Lathes; Boring Mill, Milling Machines, Cylindrical Grinders, Hydraulic Wheel Press, Chain Hoist, Fabricating Equipment, Small Tools, etc. All Motor Driven & modern machine tools.

FS-246, Amer. Mach., 330 W. 42nd St., N. Y. C.

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MACHINISTS
AND TOOL MAKER'S HANDY BOOK

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1600 PAGES FULLY ILLUSTRATED

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20"x120" LANDIS self contained, Motor dr.
10"x48" BROWN & SHARPE, #14; Belt Dr.
12x36" CINCINNATI Plain, Arr. Motor Dr.
12x36" CINCINNATI UNIVERSAL, Belt Dr.

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Motor Drive; Cap. swings 15"; Grinds automatically ¾" to 5" dia.; 4" Deep; New in 1928—looks good as new.

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Gardner #8-40" disc, 30" Ring Wheel, B.B. belt Dr.
Gardner #4-20" Disc, 16" Ring Wheel, B.B. Belt Dr.
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GARDNER #14, Ball Bearing, double opposed, 20" discs.

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15" HENDEY, Friction Drive, (5) $450 ea.
20" CINCINNATI, Geared, Crank, complete. Motorized.
25" Stockbridge, Geared, Crank, Heavy. Cone dr.
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12" Gould & Eberhard Back Geared, crank, cone dr.
7" Rhodes combination Shaper and Slotter, belt dr.
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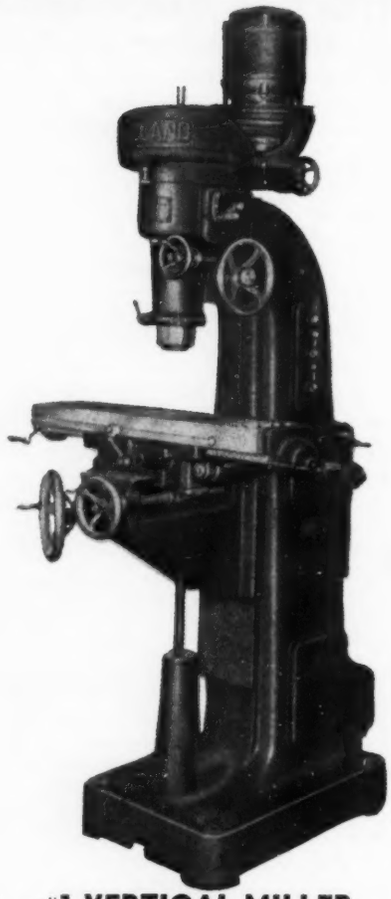

#1 VERTICAL MILLER

cap. 18" longit. feed
8½" cross travel
16" Vertical travel
table working surface 8"x32"

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GISHOLT 24"x6¼" hole thru spindle Universal, Taper attach. Chuck, Tooling. Motor dr. perfect condition, immediate delivery. Rare bargain.

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AMERICAN 5' Arm, semi Universal, 12" col., arr. Motor drive.
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DRESES 4' Arm Plain Radial, cone dr.

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#7H Becker Lincoln Type Production Miller
#12 Pratt & Whitney Lincoln Production Miller
#2 Pratt & Whitney Lincoln Production Mill
#2 Kempsmith Lincoln Production Mill
#2 GARVIN DUPLEX PRODUCTION MILL
#12 PRATT & WHITNEY DUPLEX PRODUCTION MILL

DIE CASTING MACHINES

3—MADISON-KIPP late model, 10" x 12", 12" x 14", 12" x 16"

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#18 Bliss OBI
#19 Bliss OBI (4)
#19 Truesdale OBI
#4 Adriance OBI
#19C Bliss OBI
#18C BLISS OBL
#4 MICHIGAN OBI
#20B BLISS OBI
#4 V & O—OBI
#6 Waterbury Back Geared, Open Back, Inclined Legs.
#73½ BLISS S.S. Plain flywheel.
#4 BLISS Back Flywheel Plain.
#4 Bliss Back Flywheel Geared,
#2 BLISS Back Flywheel Plain (6)
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#15N BLISS, arr. Geared Motor dr. (2)
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1500# Chambersburg Steam Hammer, single leg.
50# DuPont Blacksmith Hammer
15# Bradley upright Strap Hammer.
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#25 NIAGARA ARCH PRESS, Plain
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#72 Waterbury Coining Press 50 Tons
#166 Consolidated Dble Crank Geared Press; Air Cushions
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#3 American Can Co OBI
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SHERIDAN EMBOSSING PRESS, 24x36
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520 Ton Southwark Hydraulic with Laurie Pump

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42" BRIDGEPORT VERTICAL BORING MILL
2 Heads on Cross Rail

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36" Gould & Eberhard "Victoria Model" perfect Cond.
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#36B Gould & Eberhard Spur and Bevel Gear Cutter, Motor Dr.
#0 #1 #2 #3 STANDARD AUTOMATIC GEAR CUTTERS, BILTONS

HAMMOND 10 H.P. BUFFERS—8 months old. (3) Motors in base, 3-60-220/440 v.

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#2 GARVIN SINGLE SPINDLE PROFILER, Belt dr.

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Kutscheid all steel 36" x 16 ga. Foot Shear
Pexto 48" x 16 ga. Foot Shear
Pittsburgh 36" x 3/4" Plate Shear, no holddown
UNITED ENGINEERING PLATE SHEAR 42" x 3/16 no holddown
MESTA ENGINEERING Plate Shear 42" x 3/8 Plate, Motor dr.
#216 NIAGARA RING AND CIRCLE SHEAR, Motor Dr.
#132 BLISS 14 ga. 12" throat, Slitter
#236 PEXTO CIRCLE SHEAR, SPD.; 16 ga.
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12' x 3/8 and 6'x3/8 STAMCO MILL PACK SHEAR, complete
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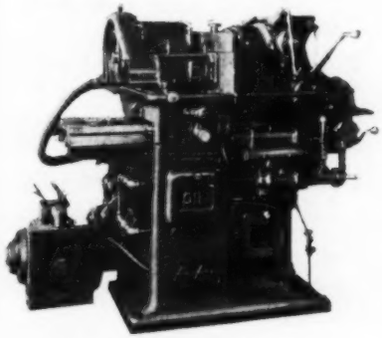

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Internal Grinder
Hydraulic feed
Motor drive—3-60-220
Swings 15"—Grinds
4" deep,—5" dia.
fully automatic

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VERTICAL ROTARY SURFACE GRINDER

COVELL-HANCHETT #940 Capacity 40"; takes 12" Wheel; MOTOR DRIVEN, Ball Bearing throughout. Perfect condition. Immediate delivery—Cost $10,100. Sale price $6000.00.

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Sliding Head; Screw El. Tables

4 Spindle Foote-Burt High Speed Ball Bearing with power feed to each spindle automatic quick return, tight and loose pulley drive; 8" overhang #2 Morse Taper; table working surface 14" x 48"
1 Spindle Avey #3, 12" Overhang, #3 M.T. with Power feed; Ball Bearing
1 Spindle Avey #2, 8" Overhang, #2 M.T. with Power Feed; Ball Bearing
2 Spindle Avey #2, 8" Overhang, #2 M.T. Plain Hand Feed; Ball Bearing
3 Spindle Avey #2, 8" Overhang, #2 M.T.
2 Spindle Leland Gifford #2 M.T. 10" Overhang, Power feed to one Spindle
2 Spindle KERN #2 M.T. 8" Overhang
2 Spindle Henry & Wright, 8" Overhang, #2 M.T.
1 Spindle EDLUND #2B, 8" Overhang, #2 M.T.
1 SPINDLE ALLEN #2 M.T. 8" Overhang
1 Spindle FOSDICK with TAPPING MECHANISM ON SPINDLE, #2 M.T. 8" overhang
1 Spindle KOKOMO #3, 12" Overhang, Quick Change Gear box; #3 M.T.
1 Spindle Henry & Wright 8" Overhang, #2 M.T.
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28" SNYDER UPRIGHT HEAVY DUTY DRILL PRESS, BACK GEARED POWER FEED
36" SNYDER UPRIGHT HEAVY DUTY DRILL PRESS, BACK GEARED POWER FEED
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10 K.W. FEDERAL
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10x50" Norton, m.d.
10x52" Landis, m.d.
10x72" Norton, m.d.
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12x36" Cincinnati, m.d.
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Yankee Drill

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No. 60, 65, 55 Heald

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Henry & Wright Class B
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Mason Bench Type (3)
2 spindle Henry & Wright
3 spindle Avey
3 spindle Barr
3 spindle Cincinnati Pulley Machinery
3 spindle Henry & Wright Class K
4 spindle Allen
4 spindle No. 2 Fosdick, p.f.
4 spindle Gardam
4 spindle Kokomo Superior
4 spindle Henry & Wright Class K
4 spindle Henry & Wright Class B
6 spindle Henry & Wright

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4 spindle No. 2 Foote-Burt Rail
5 spindle 24" Barnes All Geared Self-Oiling
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No. 2 Baush Multiple, mechanical feeds (2)
D2 Fox Multiple Straight Line
No. 3 Baush (2)
No. 4 Baush, hydraulic feeds
No. 7D Moline 2 spindle Cylinder Borer
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10", 20", 22", 26" W. F. & John Barnes
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No. 22 Colburn Mfg.

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GLEASON 6"-11"-18" Bevel Gear Generators

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GRAY 30"x30"x8' Planer — 2 heads on cross rail—M.D.

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AJAX 3" All Steel Upsetter

SAUNDERS 8"-18" Pipe Threader, M.D.

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14" x 6' Lodge & Shipley Lathe, 3 S.C.D. D.B.G. Q.C.
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42" x 16' Niles Lathe, Standard Change, Cone Drive.
28" x 50" x 16' Rahn Larmon Slid. Bed Gap Lathe, Q. C.

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#60 Heald Internal, Belt Drive.
12" Pratt & Whitney Surface Belt Drive.
#14—20" Besley Disc Grinder, Belt Drive.
12" x 72" Cincinnati Universal, Belt Drive.
#41 Oliver Drill Grinder, M.D.

GEAR CUTTERS

#3—26" B & S Automatic Gear Cutter.
#1 Adams Gear Hobber, Belt Drive.

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36" Bullard Vertical, Two Heads, M.D.

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4" Williams Pipe Machine.
2" Landis Pipe Machine.
2" Landis Dble. Spindle Bolt Threader.
½" Acme Bolt Cutter Class A.
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6' Niles Universal Radial Drill, S.P.D.

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24" Queen City Crank Shaper.
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24" x 24" x 6' Cincinnati, Planer.

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2 ton **American** vertical

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No. 36 BM **Gould & Eberhardt** adjustable angle 3 spindle bevel
Lipe 2 spindle chamferer
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National Tool Co. gear check

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10"x24" & 12"x36" **Landis**
10"x36" **Norton**
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24" No. 4 **Gardner** disc
18" **Gardner** semi automatic disc
24", No. 84 **Gardner** opposed disc
24", No. 231 **Hanchett** opposed disc
53", No. 24 **Gardner** disc
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2⅜" **Oliver** drill
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Gisholt tool grinder
24" **Ingersoll** cutter
No. 1 **Leblond** univ. tool & cutter
No. 1½ **Cincinnati** univ. tool & cutter
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84" **Diamond** face & edge
Pratt & Whitney worm or thread

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No. 33 **Kempsmith Mfg.**
No. 6 **Whitney** hand
Kempsmith hand
No. 3½ **Fox** hand
No. 12 **Browne & Sharpe Mfg.**
12" plain and BG **Cincinnati Mfg.**
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No. 3C **Lees Bradner** thread
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Type AB **Becker** vertical
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Nos. 1 & 1A **Davis & Thompson** drum type duplex
Nos. 10 & 45 **Bilton** Productomatics
60" **Ingersoll** continuous rotary

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1¼" x 4, 12" throat **Cleveland** horizontal
1¾" x 1", No. 1½ **Long & Alstatter**, 12" throat
¾" x ¾", 26" throat **Rock River**
No. 54 **Beloit** combination

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54" **McKay** 17 roll straightener
No. 1A **Ajax** taper forging

SWAGERS
No. 208 **Etna**
No. 6 **Langelier** with feeder

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16" **Walcott**
16" **Hendey**
22" **Ohio**
36" **Morton**
12" **Dill** slotter

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¼" **Bodina** automatic nut, hopper feed
⅜" **National** precision nut, hopper feed
⅝" **Rickert Shafer** horizontal
Nos. 1 & 2X **Garvin**
Natco 1 and 2 way lead screw

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½" **Webster** ¾ **Perks** double
½" **Acme** double
¾" **Economy**, hopper feed
1", 2" & 2½" **Landis** single
2" & 2½" **Landis** double
1½" **Geometric**
1½" **Rogaco** pipe machine

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1¼" **American**
1½" **Acme**
2" **National**, extended ram guide
2½" **Ajax** twin geared, suspended slides
4" **Ajax** original model, single geared
4" **Ajax** twin geared, suspended slides

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No. 21½ **Bliss** OBI geared
71 ton **Waterbury Farrell** OBI
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No. 76 **Toledo** openback
750 ton **Baldwin Southwark** hydraulic toggle, 11' 10½" between uprights, triple action
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28", No. 71 **Swaine** double crank
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No. 14½ **Toledo**, swing table
No. EL6 **Ferracute** straight side
No. 53 **Toledo** straight side
No. 4 **Massillon** straight side
No. 7 **Rockford** straight side
No. 8-7 **Zeh & Hahnemann** straight side
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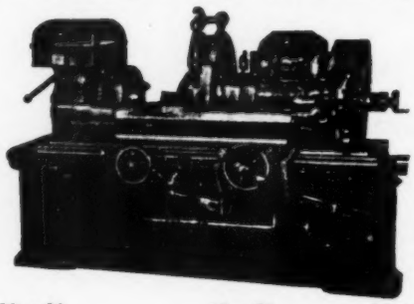

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10 x 36	14 x 36	14 x 96
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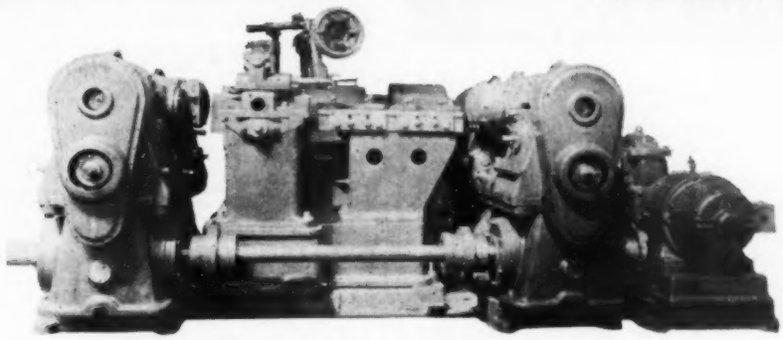

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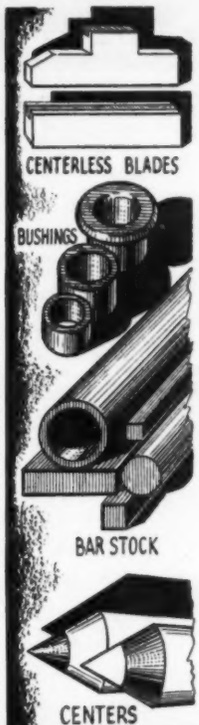

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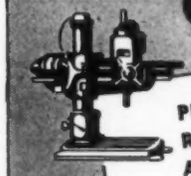

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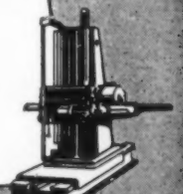

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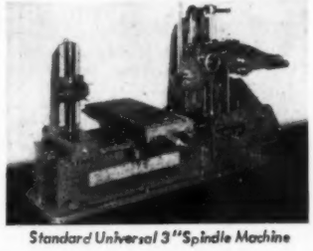

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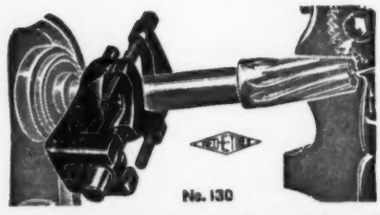

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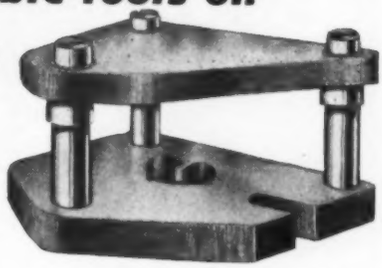

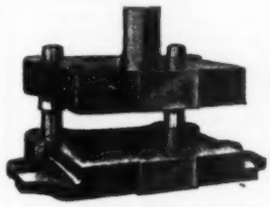

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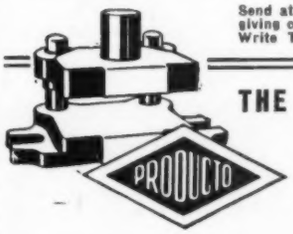

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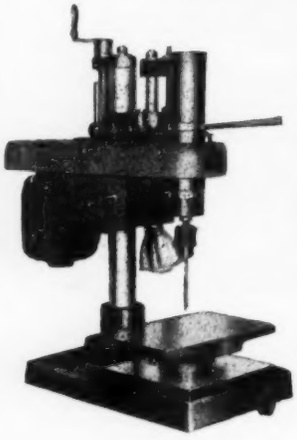

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Buffalo Forge Co., Buffalo, N. Y.
Delta Mfg. Co., Milwaukee
Production Machine Co., Greenfield, Mass.

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Baker Brothers, Inc., Toledo, Ohio
Barnes Drill Co., Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati, Ohio
Foote-Burt Co., Cleveland

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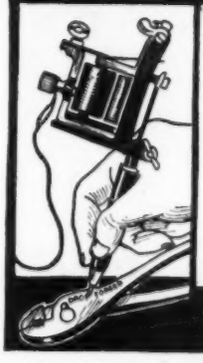

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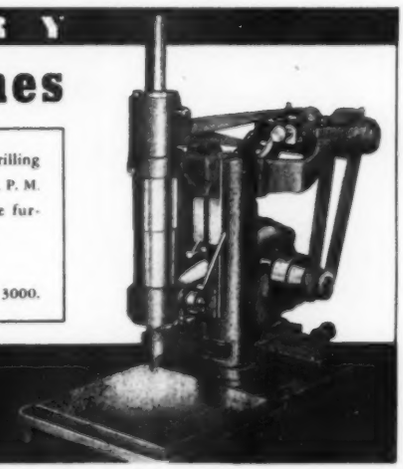

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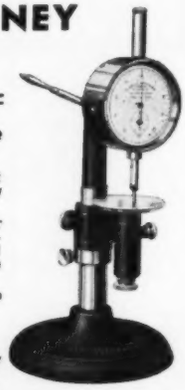

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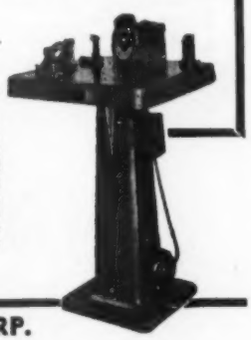

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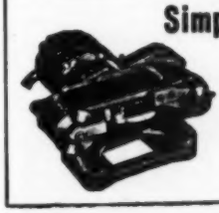

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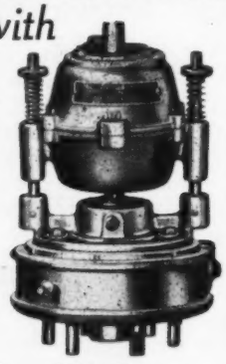

Above: Drive Unit of the Tapping Head with Gear Case bolted to its face plate.

Ball-bearing Drive Unit for Drilling to which Gear Case is interchangeably bolted.

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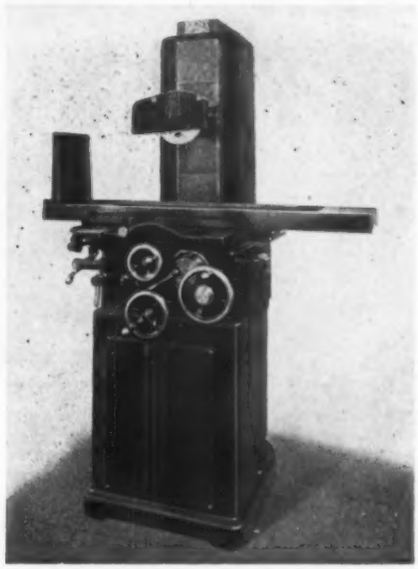

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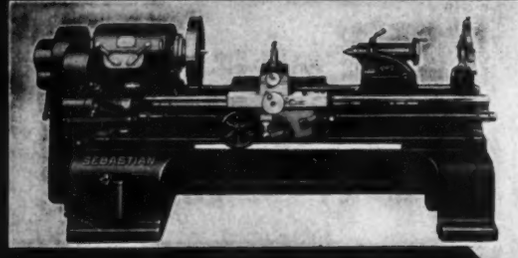

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Starrett Co., L. S., Athol, Mass.

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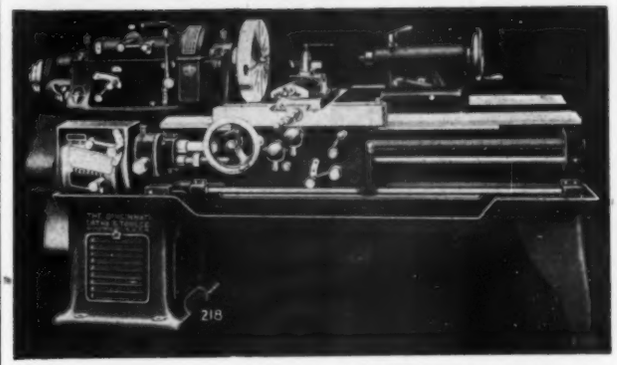

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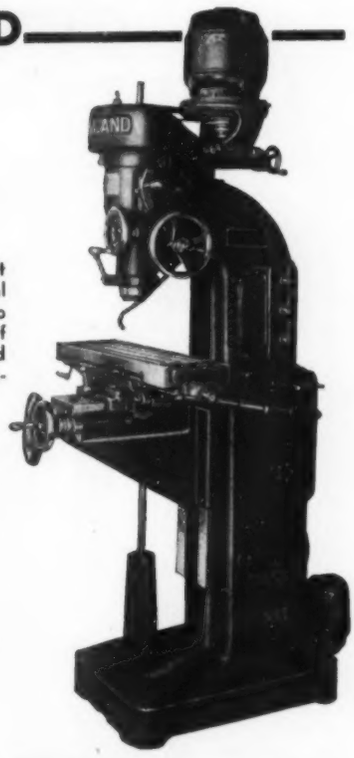

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Knight Machinery Co., W. B., St. Louis, Mo.
Leach Machinery Co., H., Providence, R. I.
Nichols & Sons, W. H., Waltham, Mass.
Ohio Machine Tool Co., Kenton, Ohio
Sidney Machine Tool Co., Sidney, Ohio

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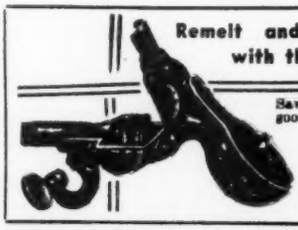
Consolidated Mach. Tool Corp., Rochester, N. Y.



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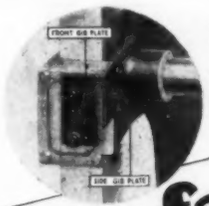

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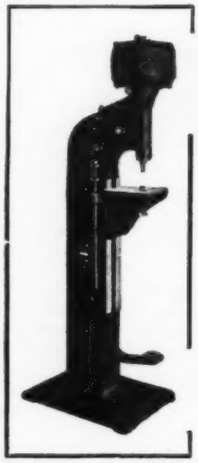

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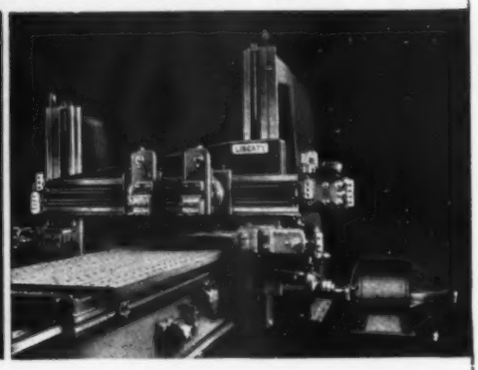

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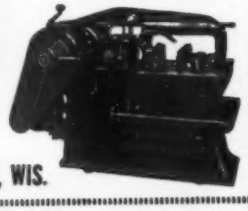

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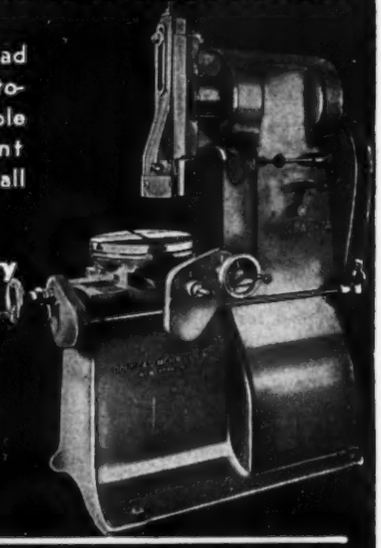

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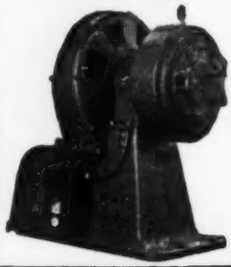

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Card Mfg. Co., S. W., Mansfield, Mass.

SCREW THREADING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

SCREWS, Cap and Set
Allen Mfg. Co., Hartford, Conn.
Danly Mach. Specialties Co., Inc., Chicago, Ill.
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Lamson & Sessions Co., Cleveland, Ohio
Parker Kalon Corp., N. Y. C.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Recessed Head
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Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit
Lamson & Sessions Co., Cleveland
National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker Co., Charles, Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., Chicago, Ill.
Phillips Screw Manufacturers, Providence, R. I.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
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Shakeproof Lock Washer Co., Chicago, Ill.
Southington Hardware Mfg. Co., Southington, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
Whitney Screw Corp., Nashua, N. H.

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Parker Kalon Corp., N. Y. C.
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Strong, Carlisle & Hammond Co., Cleveland.

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Allen Mfg. Co., Hartford, Conn.
Parker Kalon Corp., N. Y. C.
Standard Pressed Steel Co., Jenkintown, Pa.

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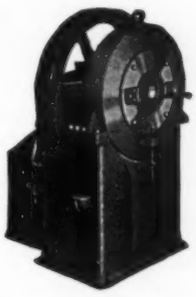

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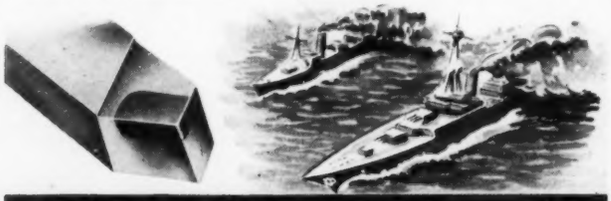

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Smith & Mills Co., Cincinnati, Ohio

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Jones & Laughlin Steel Corp., Pittsburgh
U. S. Steel Corp., Pittsburgh

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Carborundum Co., Niagara Falls, N. Y.

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O'Neil-Irwin Mfg. Co., Minneapolis

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Sparks Machine Tool Corp., Norwalk, Conn.

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Lincoln Electric Co., Cleveland

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Douglas Machy. Co., Inc., N. Y. C.

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Union Twist Drill Co., Athol, Mass.

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Williams & Co., J. H., Buffalo, N. Y.

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Stahl Gear & Machine Co., Cleveland
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SPINDLES, Grinding
Excello Corp., Detroit

SPOT WELDER CONTROL
General Electric Co., Schenectady, N. Y.

SPROCKETS
Grant Gear Wks., Boston, Mass.

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Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

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Noble & Westbrook Mfg. Co., Hartford, Conn.

STARTERS, Motor
Lincoln Electric Co., Cleveland

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STEEL, Alloy Cold Drawn
Carpenter Steel Co., Reading, Pa.
Copperweld Steel Co., Glassport, Pa.
Union Drawn Steel Co., Massillon, Ohio

STEEL, Carbon
Carpenter Steel Co., Reading, Pa.
Timken Roller Bearing Co., Canton, Ohio
Wyckoff Drawn Steel Co., Pittsburgh

STEEL, Cold Finished
Jones & Laughlin Steel Corp., Pittsburgh

STEEL, High Speed
Armstrong Bros. Tool Co., Chicago
Carpenter Steel Co., Reading, Pa.
Vascoloy Ramet Division of Vanadium Alloy Steel Co., Chicago

STEEL, Screw
Jones & Laughlin Steel Corp., Pittsburgh
Union Drawn Steel Co., Massillon, Ohio

STEEL SETTERS
Errington Mech. Lab., Staten Island, N. Y.

STEEL, Stainless
Carpenter Steel Co., Reading, Pa.
Copperweld Steel Co., Glassport, Pa.

STEEL, Tool
Armstrong Tool Co., Chicago
Bissett Steel Co., Cleveland
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Momax Division, Cleveland
Climax Molybdenum Co., N. Y. C.
Copperweld Steel Co., Glassport, Pa.

STEELS, Alloy Carbon & High Speed
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Jones & Laughlin Steel Corp., Pittsburgh
Republic Steel Corp., Cleveland
U. S. Steel Corp., Pittsburgh

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Aluminum Co. of America, Pittsburgh

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Modern Tool Works, Rochester, N. Y.

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Waltham Machine Works, Waltham, Mass.

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Ultra-Lap Machine Co., Detroit

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Lombard Governor Corp., Ashland, Mass.
Machine Products Corp., Detroit

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Torrington Co., Torrington, Conn.

SWITCHES
Clark Controller Co., Cleveland

SWITCHES, Electric, Limit, Safety
Allen-Bradley Co., Milwaukee

TACHOMETERS
Brown Instrument Co., Philadelphia

TANKS, Aluminum
Aluminum Co. of America, Pittsburgh

TAPES, Measuring
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

WHERE-TO-BUY DIRECTORY

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TAPER PINS
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

TAPPERS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.

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Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati, Ohio
Dorman Tool & Machine Works, N. Y. C.
Errington Mech. Lab., Staten Island, N. Y.
Ettco Tool Co., Brooklyn, N. Y.
Greenlee Bros. & Co., Rockford, Ill.
Haskins Co., R. G., Chicago, Ill.
Kingsbury Mach. Tool Corp., Keene, N. H.
Moline Tool Co., Moline, Ill.
Murchey Machine & Tool Co., Detroit

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Hanson-Whitney Machine Co., Hartford, Conn.
Landis Mach. Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.

TAPS, Ground
Card Mfg. Co., S. W., Mansfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Wood & Spencer Co., Cleveland

TAPS, Collapsing
Landis Mach. Co., Waynesboro, Pa.
Modern Tool Works, Div. Consolidated Machine Tool Corp., Rochester, N. Y.
Murchey Machine & Tool Co., Detroit, Mich.

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Shore Instrument & Mfg. Co., Jamaica, N. Y.
Wilson Mechanical Instrument Co., New York, N. Y.

THERMOCOUPLES
Brown Instrument Co., Philadelphia

THERMOMETERS
Brown Instrument Co., Philadelphia

THREAD CHECKING EQUIPMENT
Cadillac Gage Co., Detroit

THREAD CUTTING MACHINES
Dalzen Tool & Mfg. Co., Detroit
Eastern Mach. Screw Corp., New Haven, Conn.
Excello Corp., Detroit
Geometric Tool Co., New Haven, Conn.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Landis Mach. Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
Oster Mfg. Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Waltham Machine Works, Waltham, Mass.
Warner & Swasey Co., Cleveland

THREAD CUTTING TOOLS
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Geometric Tool Co., New Haven, Conn.
Hanson-Whitney Machine Co., Hartford, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mach. Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Murchey Machine & Tool Co., Detroit, Mich.
Peerless Machine Co., Racine, Wis.
Rivett Lathe & Grinder, Inc., Boston, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREADERS, Pipe
Armstrong Bros. Tool Co., Chicago
Peerless Machine Co., Racine, Wis.
Warner & Swasey Co., Cleveland

TONGS, Lifting
Armstrong Bros. Tool Co., Chicago

TOOL BITS
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Gisholt Machine Co., Madison, Wis.
Jones & Lamson Mach. Co., Springfield, Vt.
McKenna Metals Co., Latrobe, Pa.
Warner & Swasey Co., Cleveland

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Remington Rand, Inc., Buffalo, N. Y.

TOOL HOLDER BITS
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Auto Ordnance Corp., Bridgeport, Conn.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Mach. Co., Springfield, Vt.
Ready Tool Co., Bridgeport, Conn.
Sturdimatic Tool Co., Detroit, Mich.
Warner & Swasey Co., Cleveland, Ohio
Williams & Co., J. H., Buffalo, N. Y.

TOOL POSTS, Lathe
Williams & Co., J. H., Buffalo, N. Y.

TOOL STANDS
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TOOL WORK
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOLS, Boring
Armstrong Bros. Tool Co., Chicago
Bullard Co., Bridgeport, Conn.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
McKenna Metals Co., Latrobe, Pa.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Carbide Alloy
Crafts & Co., Inc., Arthur A., Boston, Mass.
Jones & Lamson Machine Co., Springfield, Vt.
Tungsten Electric Co., North Bergen, N. J.
Vascoloy Ramet Division of Vanadium Alloy Steel Co., Chicago
Warner & Swasey Co., Cleveland

TOOLS, Cemented Carbide
Gairing Tool Co., Detroit

TOOLS, Cutting
Gairing Tool Co., Detroit
National Tool Co., Cleveland

TOOLS, Cutting-Off
Armstrong Bros. Tool Co., Chicago
Empire Tool Co., Detroit
Jones & Lamson Machine Co., Springfield, Vt.
McKenna Metals Co., Latrobe, Pa.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Diamond Tipped
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Diamond Tool Co. (Not Inc.), Chicago
Smit & Sons, Inc., J. K., N. Y. C.

TOOLS, Hand
Capewell Mfg. Co., Hartford, Conn.
Gairing Tool Co., Detroit
Starrett Co., L. S., Athol, Mass.

TOOLS, Knurling
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Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
McKenna Metals, Latrobe, Pa.
Warner & Swasey Co., Cleveland

TOOLS, Lathe, Shaper and Planer
Apex Tool & Cutter Co., Shelton, Conn.
Armstrong Bros. Tool Co., Chicago
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Pipe Threading
Armstrong Bros. Tool Co., Chicago
Warner & Swasey Co., Cleveland

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Chicago Wheel & Mfg. Co., Chicago

TOOLS, Portable Elec. & Pneumatic
Onsrud Machine Works, Inc., Chicago

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Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Thread Cutting
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Tungsten Carbide Tipped
Crafts Co., Arthur A., Boston, Mass
Gairing Tool Co., Detroit
Jones & Lamson Machine Co., Springfield, Vt.
Warner & Swasey Co., Cleveland

TOOLS, Turning
Jones & Lamson Machine Co., Springfield, Vt.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Turret Lathe and Screw Machine
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Jones & Lamson Machine Co., Springfield, Vt.
Warner & Swasey Co., Cleveland

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Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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Reeves Pulley Co., Indianapolis, Ind.

TRUCKS, Hand
Standard Pressed Steel Co., Jenkintown, Pa.

TRUCKS, Steel
Standard Pressed Steel Co., Jenkintown, Pa.

TUBING, Aluminum, Seamless
Aluminum Co. of America, Pittsburgh

TUBING, Copper, Brass, Bronze
Lewin-Mathes Co., East St. Louis, Ill.

TUBING, Seamless
Lewin-Mathes Co., East St. Louis, Ill.

TUBING, Tool Steel
Bissett Steel Co., Cleveland

TUNGSTEN CARBIDE TOOLS
Metal Carbides Corp., Youngstown, Ohio
Warner & Swasey Co., Cleveland

TURBINES, Steam
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TURRETS, Tool Post
American Tool Wks. Co., Cincinnati
Gisholt Machine Co., Madison, Wis.
Jefferson Machine Tool Co., Cincinnati
Jones & Lamson Machine Co., Springfield, Vt.
Warner & Swasey Co., Cleveland

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Gray & Prior Machine Co., Hartford, Conn.

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Davis Machry. Co., N. Y. C.
Dony Machry. Co., D. E., Rochester
Eastern Machinery Co., Cincinnati
Emerman & Co., Louis E., Chicago
Falk Machinery Co., Rochester, N. Y.
Hill-Clarke Machinery Co., Chicago
Hyman & Sons, Jos., Philadelphia
Indianapolis Machinery & Supply Co., Indianapolis, Ind.
Interstate Machy. Co., Inc., Chicago
Iroquois Machy. Co., Buffalo, N. Y.
Lang Machinery Co., Pittsburgh, Pa.
Marsh Machry Co., A. R., Cleveland
McDonald Machry Co., St. Louis, Mo.
Miles Machy. Co., Saginaw, W. S., Mich.
Morey & Co., Inc., New York, N. Y.
New York Machinery Co., N. Y. C.
O'Brien Machinery Co., Phila., Pa.
Osborne & Sexton Machy. Co., Columbus, Ohio
Ott Mach. Sales Co., Detroit, Mich.
Reconstruction Machine Tool Corp., N. Y. C.
Rosenkranz Machy. Co., N. Y. C.
S. & S. Machry. Co., N. Y. C.
Simmons Machine Tool Corp., Albany
Victor Machinery Co., Chicago
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Wigglesworth Machinery Co., Cambridge, Mass.
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Schraders Son, A., Brooklyn, N. Y.

VALVES, Air Control
Berkeley Equipment Co., Lorry, Pa.
Brown Instrument Co., Philadelphia
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Ross Operating Valve Co., Detroit

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Starrett Co., L. S., Athol, Mass.

VISE STANDS
New Britain-Gridley Machine Co., New Britain, Conn.

VISES, Drilling Machine
Armstrong Bros. Tool Co., Chicago
Fenn Mfg. Co., Hartford, Conn.
Hartford Special Machy. Co., Hartford, Conn.
Johnson Tool Co., East Providence, R. I.
Sheldon Machine Co., Chicago

VISES, Machinist
Desmond-Stephan Mfg. Co., Urbana, Ohio
Fenn Mfg. Co., Hartford, Conn.

VISES, Milling Machines
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, Ohio
Fenn Mfg. Co., Hartford, Conn.
Hartford Special Machy. Co., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee
Sheldon Machine Co., Chicago

VISES, Pipe
Armstrong-Blum Mfg. Co., Chicago
Williams & Co., J. H., Buffalo, N. Y.

WELDED EQUIPMENT
Bayard & Co., M. L., Philadelphia

WELDERS, Arc
Hobart Bros., Troy, Ohio

WELDERS, Electric
Ohio Machine Tool Co., Kenton, Ohio

WELDING, Accessories
Cullen-Friestadt Co., Chicago

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Lincoln Electric Co., Cleveland
Mallory & Co., Inc., P. R., Indianapolis, Ind.

WELDING ELECTRODES
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Page Steel & Wire Div. American Chain & Cable Co., Inc., Monessen, Pa.

WELDING GOGGLES & HELMETS
Lincoln Electric Co., Cleveland

WELDING MACHINES, Electric Arc
Harnischfeger Corp., Milwaukee
Lincoln Electric Co., Cleveland

WELDING MACHINES, Spot
Progressive Welder Co., Detroit
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

WELDING SUPPLIES, Electric
General Electric Co., Schenectady, N. Y.

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Hobart Brothers, Troy, Ohio

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Aluminum Co. of America, Pittsburgh

WHEELS, Steel, Steam, Electric, Speed, Industrial
U. S. Steel Corp., Pittsburgh

WIRE, Aluminum
Aluminum Co. of America, Pittsburgh

WIRE
Jones & Laughlin Steel Corp., Pittsburgh
Roebling's Sons Co., John A., Trenton, N. J.

WIRE & CABLE
General Electric Co., Schenectady, N. Y.
Roebling's Sons Co., John A., Trenton, N. J.

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Walker Turner Co., Inc., Plainfield, N. J.

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Perkins Mach. & Gear Co., Springfield, Mass.

WORMS
Gear Specialities, Inc., Chicago, Ill.

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Williams & Co., J. H., Buffalo, N. Y.

WRENCHES, Drop Forged
Williams & Co., J. H., Buffalo, N. Y.

WRENCHES, Machinist
Armstrong Bros. Tool Co., Chicago
Williams & Co., J. H., Buffalo, N. Y.

WRENCHES, Pipe
Armstrong Bros. Tool Co., Chicago

WRENCHES, Ratchet
Greene Tweed & Co., N. Y. C.
Williams & Co., J. H., Buffalo, N. Y.

WRENCHES, Socket
Armstrong Bros. Tool Co., Chicago
Black & Decker Mfg. Co., Towson, Md.
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